

BRIDGING THE DIGITAL DIVIDE FOR ARTIFICIAL INTELLIGENCE (AI) READY LEARNERS

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Abstract

Artificial Intelligence (AI) is revolutionizing various sectors, contributing significantly to the global economy and driving digital transformation. While AI offers innovative solutions across healthcare, education, business, and sustainability, its full potential is realized through digital literacy. Although AI can function with minimal digital skills, effectiveness is limited without a foundational understanding of digital concepts. AI-ready learners, equipped with technical and soft skills, are crucial for bridging the digital divide, promoting equitable access to digital resources, and fostering a more inclusive AI-driven future. The digital divide, particularly pronounced in developing regions, presents significant challenges that require comprehensive strategies including improved infrastructure, digital literacy programs, and inclusive AI development. By integrating AI education into curricula, enhancing teacher training, and fostering diversity, we can prepare individuals for AI-driven opportunities and ensure responsible AI deployment. Ultimately, bridging the digital divide through these multifaceted efforts is essential for achieving digital equality and maximizing the societal benefits of AI.

Keywords: Digital Divide, AI Ready Learners, AI Learners, Digital Literacy.

Introduction

Artificial Intelligence has made an innovative transformation across the living style. AI is expected to contribute \$15.7 trillion to the global economy by 2030. Furthermore, AI is seen as a key enabler of digital transformation, with a multi-dimensional role in driving intelligent transformation (Naseeb, 2020). AI is driving significant transformations and innovations across various sectors, including healthcare, education, business, and sustainability (Geetha, 2023). This innovation in every sphere of life is advancing by offering innovative solutions that enhance learning experiences, personalize education, and improve educational outcomes. Applications of AI in different fields, lead to new inventions and advancements (Kour, 2017). The research findings by Harry, 2023 and Chhatwal, 2023 supported this ideology and said that AI has numerous potential benefits including personalized learning, increased efficiency, and improved student outcomes. The potential of AI to augment or replace human tasks and activities is also highlighted, with a focus on the opportunities, challenges, and research agenda in this area (Dwivedi, 2021; Gudigantala, 2020).

Are AI applications possible without digital literacy?

The relationship between AI applications and digital literacy is complex and multifaceted. AI has vital potential and its applications can be applicable without digital competency, though their effectiveness is limited. Some AI technologies, like voice-activated assistants or automated translation services, are designed to be user-friendly and can operate without requiring users to understand the underlying technology. For example, a person who are not digitally skilled can operate a smartphone's AI-driven virtual assistant to make life comfortable. But they can perform only simple tasks. They can use smart mobile for setting reminders or making calls through voice commands but they cannot be benefitted all the smart features of smart devices. Users may face challenges in troubleshooting, customizing settings, and fully leveraging the capabilities of these tools. The AI applications can be classified in the following categories as given in the fig.1.

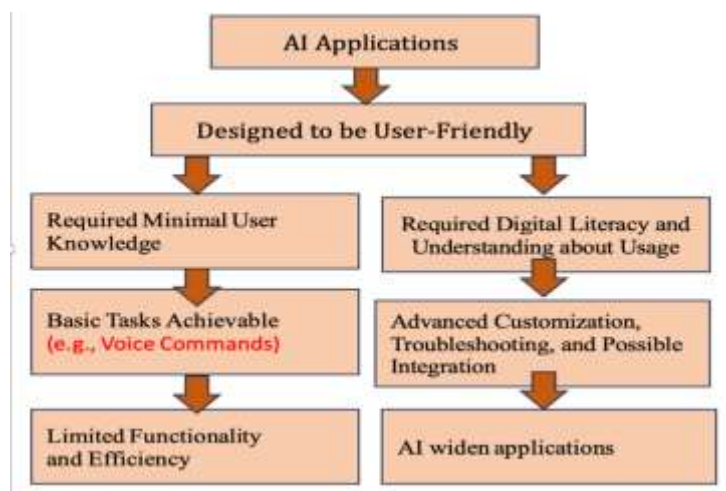


Fig.1: AI Applications

This flow chart outlines how AI applications can be used with minimal digital literacy but here shows how digital literacy can enhance the efficacy of using AI applications. Andersdotter (2023) discusses the challenges and opportunities for libraries in incorporating AI literacy into their operations and user training, underscoring the importance of AI knowledge for both librarians and users. Olari (2021) argued that AI applications demanded data literacy in K-12 education, he emphasized the interconnectedness of these competencies. Similarly, Karsol (2024) found that AI literacy can accelerate the employees' competencies in the digital workplace interlaced with generative AI and augmented analytics. AI's potential in education lies in its ability to personalize learning, create innovative content, and assist students with special needs (Pesek, 2022). Further, Chetty (2023) emphasizes how AI literacy training can be benefitted to adult workers, especially in leveraging their experience and skills to enhance productivity and efficiency. It is being used to tailor lessons, improve communication, automate administrative tasks, and provide immediate feedback (Chhatwal, 2023). The education sector is encouraged to embrace AI technologies to address modern challenges and enhance teaching methods (Ahmad, 2021). Despite these benefits, challenges such as privacy concerns and potential bias need to be addressed (Harry, 2023).

Additionally, integrating AI applications into broader tasks or combining them with other digital resources may be difficult, leading to reliance on a limited set of functionalities. Thus, while AI can provide valuable assistance to those with minimal digital literacy, its full potential is realized when users have a basic understanding of digital concepts and tools.

AI ready Learners

AI ready learners are individuals equipped with the knowledge, skills, and mindset necessary to thrive in an increasingly AI-driven world. These learners are proficient in understanding the fundamental concepts of artificial intelligence, including machine learning, data analysis, and algorithmic thinking. They are also adaptable and continuously seek to update their skills in response to the rapidly evolving technological landscape. Beyond technical expertise, AI-ready learners possess critical thinking, creativity, and ethical reasoning abilities, enabling them to apply AI technologies responsibly and innovatively across various domains. By embracing a lifelong learning approach, they stay ahead of trends and contribute to the development and deployment of AI in ways that benefit society as a whole.

How can AI efficacy bridge the digital divide?

AI-ready learners are poised to excel in an era where artificial intelligence is transforming industries and societal norms. To be classified as AI-ready, learners must cultivate a blend of technical and soft skills, coupled with a proactive learning attitude.

1. Technical Adeptness

- **Intellect of AI Fundamentals:** AI-ready learners must grasp basic AI concepts, including machine learning (ML), deep learning, natural language processing (NLP), and computer vision. According to a 2020 report by LinkedIn, AI skills saw a 190% increase in demand between 2015 and 2019, reflecting the growing importance of these competencies in the job market.

- **Digital Efficacy:** Proficiency in data analysis is critical. Learners should be comfortable working with large datasets, understanding statistical methods, and using tools like Python, R, and SQL. The World Economic Forum's "Future of Jobs Report 2020" highlights that data analysts and scientists are among the top job roles seeing increasing demand, with 85% of companies surveyed indicating a need for these skills.
- **Algorithmic Thinking:** This involves the ability to design, understand, and troubleshoot algorithms. Algorithmic thinking is essential for developing AI models and ensuring they operate efficiently and effectively.

2. Soft Skills and Mindset

- **Critical Thinking and Problem-Solving:** AI-ready learners must excel in critical thinking to evaluate AI applications' impacts and ethical considerations. A study by the Pew Research Center (2021) found that 67% of respondents believe critical thinking will be the most crucial skill in the future workforce.
- **Creativity:** Innovation in AI often requires creative problem-solving and the ability to think outside the box. AI-ready learners leverage creativity to develop novel solutions and applications of AI technology.
- **Ethical Reasoning:** Understanding the ethical implications of AI is paramount. AI-ready learners are aware of issues such as bias in AI systems, data privacy, and the societal impact of automation. The AI Ethics Guidelines Global Inventory, compiled by Algorithm Watch in 2020, lists over 100 sets of ethical guidelines, underscoring the widespread recognition of this need.

3. Adaptability and Lifelong Learning

- **Upskilling:** Given the rapid pace of AI advancements, learners must engage in upskilling digital efficacy. Digital mediums like Coursera, edX, and Udacity offer numerous courses on AI and ML. Coursera reported a 30% of enrolments related to AI-based courses increased only in the year 2020.
- **Interdisciplinary Knowledge:** AI-ready learners are well aware of how AI relates across the curriculum and what's are the benefits of learning such courses in healthcare, finance, and education. The "AI Index 2021 Annual Report" from Stanford University noted significant growth in AI applications across various sectors, highlighting the importance of interdisciplinary knowledge.
- **Life Experiences with AI:** Gaining hands-on experience through projects, internships, and hackathons is crucial. Kaggle, a platform for data science competitions, has over 5 million registered users, indicating a strong community of learners applying their skills in real-world scenarios.

4. Impact and Contribution

- **Workforce Transformation:** AI-ready learners have enthusiasm to transform the working pattern with AI applications. There is a high demand for AI-equipped professionals because the McKinsey Global Institute estimates that by 2030, AI could contribute up to \$13 trillion to the global economy, underscoring the economic significance of AI-ready professionals.
- **Societal Perspectives of AI Applications:** AI-driven learners are taking responsibility for upgrading the quality of life and happiness of mankind in all societal sectors such as healthcare, environmental monitoring, tracking climate changes, security issues, and other public welfare-related concerns.

It can be concluded that AI-proficient learners are tech-driven and always show concern towards 21st-century skills like innovation, critical thinking, ethics in practice, and willingness to self-paced continuing learning. These abilities enable them to be a global learner and shape the future landscape, ensuring that AI developments are beneficial and inclusive.

Current status of the digital divide across the world

The digital divide is a global issue that embarks on achieving digital equality beyond gender, demographic economically and societal. In this technocentric era of AI, the digital divide reflects the inequalities in accessing smart digital devices and the internet. Today, developed countries are enjoying widespread high-speed internet access and advanced technological infrastructure while many developing and least-developed countries lag significantly behind. International Telecommunication Union (ITU) study conducted in 2021 shows that approximately 37% of the world's population (2.9 billion people) is still deprived of internet access. This divide is evident in regions such as sub-Saharan Africa and South Asia, where Internet penetration rates are less than 30% in some areas. The digital divide, both between and within countries, remains a significant issue globally (Norris, 2001; Chen, 2004; Ho, 2006). (Norris, 2001) found in his study that this divide is evident between industrialized and developing societies, as well as between rich and poor within each nation. This reflects the global digital divide as well as the gap in digital access within countries. People living in disadvantaged areas are constrained by high costs,

language dominance, and lack of relevant materials and technology and are constantly struggling to uplift themselves (Chen, 2004).

The global trend of the digital divide persists, characterized by the simultaneous narrowing of the gap in developed and rapidly developing regions, and the widening divide in other developing and least-developed areas (Ho, 2006). These findings underscore the critical need for ongoing efforts to bridge the digital divide and ensure equitable access to digital resources. Factors that widen the gap due to poverty include low economy, lack of infrastructure, and educational backwardness. In contrast, urban areas in developed nations avail of universal connectivity and ultra-smart digital services. Therefore, it is a global need to bridge the divide through investments in infrastructure, initiatives to lower costs, and enhancement in digital literacy. However, the pace of these efforts varies across countries and time, which further exacerbates social and economic inequalities through the digital divide. Therefore, there appears to be a need for concerted global action to ensure equitable access to digital technologies and the Internet.

Digital Divide and Challenges for Future Generation

The digital divide remains a major challenge in the current era of the information revolution, due to which people in underdeveloped and developing countries are not able to get better connectivity facilities and standard digital skills and they remain starkly behind, deepening social and economic disparities and comparison to developed and rapidly developing regions. Malhan, 2003; Singh, 2010 explored that the digital divide, a significant challenge in the development of the information society, is particularly pronounced in developing countries like India. The digital divide, exacerbated by the COVID-19 pandemic, has underscored the need for AI integration in education (Abuodha, 2024). This divide is multifaceted, affecting various social groups and requiring a range of strategies to address it (Zdjelar, 2021). The role of education and technological research is crucial in bridging this gap, with a focus on connectivity provision, content creation, and capacity augmentation (Ranieri, 2009). Despite the efforts of organizations and governments, obstacles such as illiteracy, lack of skills, and infrastructure continue to hinder progress in reducing the digital divide (Singh, 2010).

Bridging the Digital Divide with AI

However, this integration presents challenges such as data privacy concerns and the need for infrastructural changes. To address these challenges, Luttrell (2020) proposes five considerations for communication education, while Karsenti (2019) emphasizes the urgency of preparing teachers for the AI-driven era. Shamir (2013) highlights the importance of cognitive education in bridging the gap between theory and practice, particularly in the context of digital platforms. These studies collectively underscore the need for a comprehensive approach to bridging the digital divide and preparing learners for the AI-driven era.

Pillars to bridge the digital gap

The digital divide is a multifaceted issue, with key pillars including literacy, access, content, and training (Wilhelm, 2001). In Asia, infrastructure targets and user community empowerment are crucial for bridging this gap (Sharma, 2006). Public policy, particularly in developing nations, can play a significant role in addressing the digital divide, with a focus on education, e-governance, and infrastructure (Chary, 2010). Access equality, particularly in terms of broadband access, is a critical aspect of bridging the digital divide, and policy changes are essential in this regard (El-Bawab, 2020). Hence the research studies suggest the following main four pillars that can fill the gap of the digital divide. Therefore, based on the research, it can be suggested that the following four main pillars can play an important role in bridging the digital divide. This can be understood from Fig. 2 as shown below-

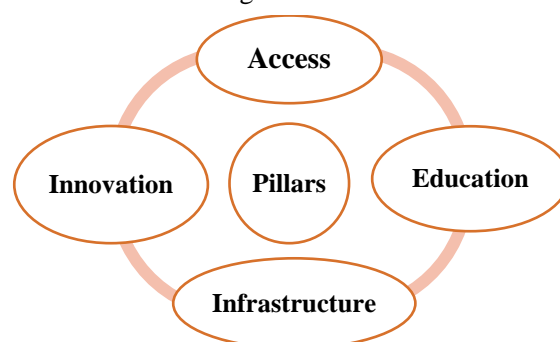


Fig. 2: Pillars of AI

1. **Access:** An icon of a satellite or Wi-Fi symbol connecting rural and underserved areas to the Internet.
2. **Education:** A symbol of a graduation cap or an online learning platform, showing how AI provides personalized learning and access to educational resources.
3. **Infrastructure:** Icons of servers, cloud computing, and 5G towers, representing the physical and digital infrastructure supported by AI for better connectivity.
4. **Innovation:** Symbols of robots, AI assistants, and research, illustrating how AI fosters innovation and provides new solutions to digital access issues.

Bridging the digital divide to prepare AI-ready learners involves addressing the stark disparities in access to digital resources that hinder educational and professional opportunities in Artificial Intelligence (AI). To effectively bridge this divide, comprehensive efforts are needed. These include improving infrastructure to ensure widespread access to broadband internet and necessary computing devices. Initiatives should also focus on implementing robust digital literacy programs that equip learners with foundational skills in computer usage, internet navigation, and proficiency with digital tools—critical prerequisites for engaging with AI technologies.

Integrating AI education into formal curricula at all educational levels is crucial. By embedding AI concepts and skills early on, educational institutions can demystify AI and inspire diverse groups of students to pursue AI-related fields. Equally important is enhancing teacher training to equip educators with the knowledge and pedagogical tools necessary to effectively teach AI concepts and foster AI literacy among students. Partnerships between educational institutions, governments, industry stakeholders, and nonprofit organizations play a pivotal role. Collaborative efforts can facilitate the development and dissemination of open educational resources (OER) tailored to AI education, making learning materials more accessible and adaptable across diverse learning environments. Moreover, fostering diversity and inclusivity within AI education and industry is imperative. By promoting equitable opportunities and showcasing diverse perspectives and contributions to AI development and applications, we can create a more inclusive and innovative AI ecosystem.

Ethical considerations also warrant attention. Discussions around the ethical implications of AI, including issues of bias, privacy, and transparency, should be integrated into AI education to empower learners to navigate these complex challenges responsibly.

Ultimately, by implementing these multifaceted strategies informed by research data and collaborative efforts, we can bridge the digital divide for AI-ready learners. This approach not only enhances individual readiness for AI-driven opportunities but also contributes to a more equitable and sustainable future for global AI development and adoption.

Inclusive AI for Digital Equality

Inclusive AI plays a pivotal role in promoting digital equality by addressing barriers and empowering underserved communities worldwide. By its very design, inclusive AI seeks to mitigate the disparities exacerbated by the digital divide. It achieves this by enhancing accessibility through innovations like voice recognition, text-to-speech, and intuitive user interfaces, which cater to diverse linguistic, cultural, and literacy backgrounds. The need for inclusive AI in the public domain is underscored by Vinadio (2022), who emphasizes the importance of digital competencies in the public sector. However, Yu (2019) warns of the algorithmic divide, which can exacerbate existing inequalities. To address this, Ingram (2023) and Avellan (2020) both stress the importance of responsible AI adoption and the need for inclusive AI, respectively. The integration of AI-powered virtual classrooms in education faces several barriers, including digital literacy and language proficiency (Karroum, 2023), accessibility issues for students with disabilities (Power, 2010), and pedagogical, technological, and organizational challenges (Galofré, 2008). However, AI technologies have the potential to make education more accessible, affordable, and achievable (Goel, 2020). These findings highlight the need for further research and development to address these barriers and maximize the potential of AI-powered virtual classrooms in education.

Moreover, AI-powered solutions facilitate equitable access to essential services such as healthcare and education, breaking down geographical and socioeconomic barriers. Through personalized learning tools and adaptive technologies, AI fosters skill development and economic opportunities, ensuring that marginalized groups can participate more fully in the digital economy. Furthermore, ethical considerations in AI development ensure fairness and transparency, safeguarding against biases that could perpetuate inequalities.

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