



The Position of Lifelong Learning on Empowering Teenagers in the Knowledge Society: Enhancing AI Literacy and Life Skills

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Abstract. It is known to all that people are living in a knowledge society with the fast development of science and technology, in conjunction with broader economic and societal trends such as globalization, and alterations in family structures, which means that opportunities and challenges coexist. Simultaneously, the unprecedented change in forms of knowledge acquisition and reform of education and teaching urges young people to improve their competitiveness to survive in this world. The purpose of the research is to validate how lifelong learning frameworks empower teenagers to develop critical 21st-century capabilities: AI literacy and life skills through mixed-methods analysis of educational interventions spanning formal schooling and extracurricular domains. Finally, the study finds that lifelong learning can encourage individuals to remain informed about the most recent advancements in AI, increase investment in the field of AI literacy education, and assist in the cultivation of life skills in adolescents through the practice of sports and classroom activities.

Keywords: Lifelong Learning, Knowledge Society, AI Literacy, Life Skills

1 Introduction

From the past to the present, the control of knowledge is closely related to severe social conflict, exclusion, and inequality. For a long time, the domain of knowledge has been exclusively reserved for the enlightened and wise. The Age of Enlightenment, along with the spread of open ideas and public intellectual forums, has promoted the dissemination of the concepts of universality, freedom, and equality, which fostered the propagation of knowledge through books and the printing press, as well as the expansion of education for all through schools and universities [1]. Each society possesses its own knowledge resources. It is essential to establish a connection between the current knowledge of society and the emerging forms of knowledge that are highly regarded in the knowledge economy pattern. This indicates not only valuing traditional knowledge but also actively learning new knowledge. In the knowledge-driven society of the 21st century, the diffusion of information and communication technologies has created new opportunities for human development, which owns more diverse and abundant access

to knowledge, and knowledge itself is constantly being updated. Therefore, teenagers are supposed to learn new knowledge continuously to improve their comprehensive abilities and adapt to the current society. This paper aims to study how lifelong learning education empowers 21st-century teenagers' AI literacy and life skills. By evaluating the crucial role of lifelong education in enhancing AI understanding and practical competencies, this research will explore how lifelong learning fosters adaptability, critical thinking, and problem-solving skills in young individuals. The importance of this study derived from its potential to provide insights into effective educational strategies that can better prepare teenagers for the rapidly evolving technological landscape and the requirements of a knowledge-based society. Comprehending the impact of lifelong learning on AI literacy and life skills can further educators, policymakers, and stakeholders to formulate more inclusive and forward-thinking educational frameworks that support the holistic development of future generations.

2 Lifelong Learning

Lifelong learning refers to the combination of learning and daily life experience, encompassing a variety of learning activities that can be tailored to the varying learning needs and demands of individuals of all ages in all life-wide contexts, including the family, school, community, and work environment, across all forms of education [1]. Lifelong learning is the ongoing, voluntary, and self-directed pursuit of knowledge aimed at personal, professional, economic, or social development, which can extend beyond formal education and includes informal learning opportunities like acquiring skills, knowledge, attitudes, and behaviors from their daily experience throughout an individual's life [1]. Likewise, lifelong learning encompasses all forms of learning activities pursued across an individual's lifespan, aimed at enhancing knowledge, skills, and competencies. These pursuits are driven by personal, civic, social, or professional motivations, fostering holistic development and adaptability in an ever-evolving world [2].

When discussing lifelong learning, it is inevitable to mention the diversity and complexity of knowledge, since knowledge is a complex concept constantly explored and understood throughout a person's lifelong learning. It will explore the different categories of knowledge and the importance of lifelong learning following.

3 Different Types of Knowledge

Knowledge is a dynamic and multifaceted concept that can be broadly categorized into tacit knowledge, explicit knowledge, process knowledge, and conceptual knowledge. Michael Polanyi initially introduced the concepts of explicit and tacit knowledge in the 1960s. Tacit knowledge is the knowledge acquired by individuals through experience, practice, and intuition, which is difficult to express in words or texts and plays a key role in personal skills, professional judgment, and innovation ability. For example, the craftsmanship of a craftsman, the clinical intuition of a doctor, or the creative inspiration of an artist all rely on tacit knowledge. Explicit knowledge can be conveyed in

lexicons or texts, and it can transmit knowledge in the form of documents, databases, books, etc. Process knowledge is essential for improving efficiency, optimizing processes, and ensuring consistency. For example, production processes in manufacturing and agile methods in software development all rely on process knowledge. Conceptual knowledge originates from the fields of philosophy and education, emphasizing the understanding of abstract concepts, theories, and principles. Conceptual knowledge originates from the fields of philosophy and education, emphasizing the understanding of abstract concepts, theories, and principles. It occupies an important position in cognitive psychology and educational theory, helping people understand complex phenomena, establish theoretical frameworks, and promote the development of disciplines. For example, scientists build theoretical models through conceptual knowledge, and engineers design new systems through conceptual knowledge.

Tacit knowledge means that knowledge is embedded in the human mind through experience or muscle memory, such as insights and intuition. It is difficult to communicate, extract, and codify intuited, contextual, experiential, and cultural conveyed by socialization, coaching, discussing, and mentoring [3].

Explicit knowledge pertains to that knowledge is easily identified, described, shared, acquired, and applied, making it accessible for training and education, which can be extracted and codified in books, documents, reports, memos, etc. [4].

Procedural knowledge is associated with understanding how to perform tasks, procedures, and processes. It is often described as “know how to do”, which is characterized as step-by-step procedures executed in a specific sequence [5]. Tacit knowledge includes a wider range of non-verbalizable insights and intuitions. However, procedural knowledge, while difficult to clarify, is somewhat more structured and can be demonstrated through action

Conceptual knowledge Conceptual knowledge refers to the grasp of concepts that are abstract and adaptable, not restricted to particular problem types [6]. It can also be regarded as having a clear or intuitive comprehension of the fundamental rules or principles that control a specific area and knowing how the interconnections among knowledge units within a domain, as a result when people meet some nonstandard or unfamiliar problems, they will rely on their conceptual knowledge to generate methods for solving the problems [7].

4 Enhancing AI Literacy through Lifelong Learning

4.1 The Importance and Definition of AI Literacy

Compared to a hundred years ago, people today have access to much richer resources for gaining knowledge. The methods of teaching and the content of education have also undergone significant changes owing to the swift advancement of technological and scientific innovations. Therefore, to effectively utilize these knowledge resources and adapt to a knowledge-based society, lifelong learning is crucial for enhancing AI literacy. Moreover, AI literacy encourages a mindset of lifelong learning, helping individuals keep up with technological advancements and adapt to changes.

AI literacy commonly refers to the ability to understand, utilize, monitor, and critically evaluate AI applications without necessarily being able to develop AI models themselves, which mainly focuses on learners without a computer science background (“non-experts”) [8]. According to Long and Magerko, it mentioned that AI literacy means a collection of skills that empowers humans to critically assess AI technologies, interact and cooperate efficiently with AI, and use AI as a tool in online environments, at home, and in professional settings [9].

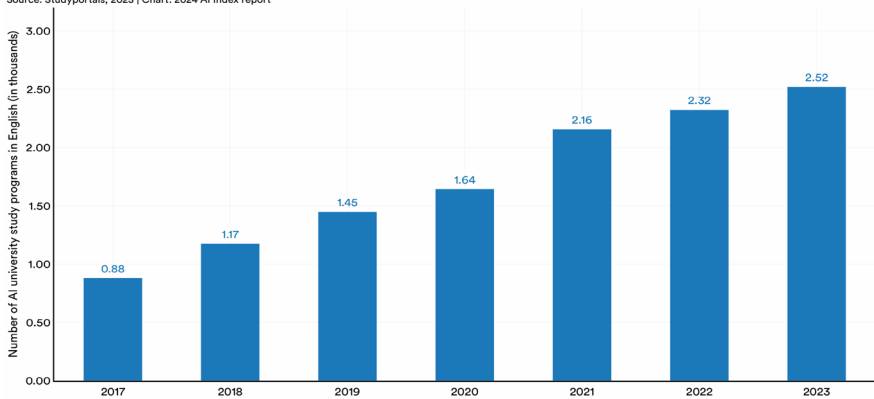
4.2 How Lifelong Learning Enhances the AI Literacy Ability

Lifelong learning motivates individuals to be informed about the most recent advancements in artificial intelligence. Considering the fast growth of breakthroughs in artificial intelligence, knowledge quickly becomes outdated. Therefore, lifelong learning stimulates relevant authority to provide access to a range of learning resources, enabling individuals to continually update their knowledge and skills in this fast-evolving field. Numerous online education platforms offer specialized courses in artificial intelligence, allowing learners to study the fundamentals and applications of AI anytime and anywhere. For example, the course titled AI For Everyone, offered by Stanford University, which is designed by renowned AI expert Andrew Ng aims to guide learners to realize the fundamental concepts, applications, and impacts of AI without requiring a programming background. Official data about this course shows that over 70% of learners report better understanding and applying AI technologies after completing the course. Lifelong learning can also promote teachers’ training for AI literacy education. The AI4K12 initiative provides guidelines and resources for integrating AI concepts into K-12 education. It offers professional development opportunities for teachers to understand AI and how to teach it. Moreover, some popular platforms like Coursera, edX, and Udacity offer structured programs that range from foundational concepts to specialized topics on AI literacy such as machine learning and deep learning.

Lifelong learning plays a crucial role in increasing investment in the field of AI literacy education. Many governments around the world have recognized the importance of promoting AI literacy through education. For instance, the UK Government’s National AI Strategy (2021) and China’s Ministry of Education initiatives (2019) emphasize the current need to integrate AI literacy into educational frameworks [10,11]. In addition, government-supported pilot programs, such as Finland’s renowned “Elements of AI” course, aim to enhance AI literacy among people of all ages and backgrounds, particularly non-experts. Figure 1 illustrates the growth in the number of AI university study programs taught in English worldwide from 2017 to 2023, whose data source is Study portals, and the chart is part of the 2024 AI Index report. Based on Figure 1, it can be found that from 2017 to 2023, the number of AI programs taught in English shows consistent growth, the number of AI programs taught in English increasing from 880 programs in 2017 to 2520 programs in 2023, which represents a nearly three times increase over six years. It is obvious that with the advancement of technology, a global surge in demand for AI professionals has prompted governments and institutions to expand their AI-related offerings in education.

Number of AI university study programs in English in the world, 2017–23

Source: Studyportals, 2023 | Chart: 2024 AI Index report

**Fig. 1.** A figure of AI university study programs offered in English worldwide from 2017 to 2023

5 The Connection between AI Literacy and Life Skills Education

It has been mentioned that AI literacy is the capability to comprehend, utilize, monitor, and critically evaluate AI applications without necessarily being able to develop AI models themselves. AI literacy helps individuals analyze how AI tools make recommendations or decisions (e.g., in search engines, social media algorithms, or financial services). This understanding fosters critical thinking and enables informed decision-making. AI tools can be used as creative aids and problem-solving resources, enabling individuals to innovate and find solutions in education, business, and personal life. AI literacy can no longer be seen as a specialized technical ability but has emerged as a vital life skill. Understanding the basics of AI, such as how machine learning algorithms work, what neural networks are, and how AI systems make decisions, equips individuals to navigate the modern world more effectively. The information on life skills will be presented in detail as follows.

(WHO) regarded life skills as the abilities for adaptive behavior that enable individuals to deal effectively with the demands and challenges of everyday life. Life skills have been classified into three broad categories [12].

- Cognitive skills are the skills that enhance the logical mindset using analytical ability, and creative and critical thinking. Furthermore, it can help people develop problem-solving and decision-making competencies.

- Social skills: Social skills include interpersonal skills, communication skills, leadership skills, management skills, cooperation and team building skills, etc. Those skills have the potential to help people embrace people's different cultural background and personalities, which can boost the global and inclusive mindset of teenagers.

- Emotional skills: Emotional skills pertain to the ability to recognize, express, and regulate your emotions. Emotional skills are the foundation of self-awareness and good

mental health. Moreover, emotional skills include managing or coping with own personal feelings, emotions, and stress, and resisting peer and family pressure. Thus, recognizing and understanding your emotions also helps people know and be comfortable with others.

Table 1. Four Types of Knowledge in AI Literacy and Life Skills.

	Tacit knowledge	Explicit knowledge	Procedural knowledge	Conceptual Knowledge
AI Literacy	Complex problem solutions: algorithm selection, model optimization	An academic textbook that covers the theory and practice of AI and machine learning	Use AI tools Programming skills	Basic concepts, history, application fields AI terms: algorithms, models, datasets
Life Skills	Interpersonal skills: know non-verbal cues and capture the unspoken language in social interactions	Language Skills: Grammar rules and vocabulary in a foreign language that can be learned through textbooks and courses	Driving a Car: The ability to operate a vehicle, including starting, stopping, steering, and following traffic rules	Understanding the principles of effective communication, including the ability to listen and express thoughts

Based on the context of the research on AI literacy and life skills, the author categorizes knowledge into four distinct types: Tacit knowledge, Explicit knowledge, Procedural knowledge, and Conceptual knowledge. Table 1 provides a general overview of each type, illustrating their characteristics and examples relevant to both AI literacy and essential life skills.

6 How to Develop Life Skills through Lifelong Learning

6.1 Lifelong Learning Can Cultivate Teenagers' Life Skills through Sports

In a recent descriptive study, Gould et al. carried out interviews in detail with high school football coaches who were recognized for their ability to impart essential life skills to their players [13]. According to their findings, the coaches' narratives shared four sets of factors in common. First of all, despite their intense desire to get the victory, the coaches had sophisticated coaching methodologies that prioritized helping their players develop life skills. Second, they were able to connect with their students and build strong relationships. Third, the coaches shared some thoughtful methods for imparting the life skills they believed were crucial. Lastly, the respondents acknowledged that interpersonal influences (like parents) and environmental factors (like socioeconomic status) affected the development of life skills and how to take actions to adjust to, manage, or overcome these challenges.

Another notable observation from the Gould et al. study was that the coaches investigated demonstrated exceptional success, with a win rate of over 70% of their games [13]. This finding is particularly noteworthy, as it directly challenges the common assumption that competitive success and life skill development are mutually exclusive pursuits in sports. Gould and Carson explained that even though these preliminary results suggest that this may not be the case and warrant further investigation into the role

of winning in the development of life skills, and the impact of life skill growth on athletic success, the coaches in this study did not view the teaching of skills as an activity separate from their regular coaching responsibilities [14]. Although they sometimes focused on specific activities to teach life skills (e.g., teaching goal setting), more often, they reported incorporating life skills teaching into their daily on-field training. Above all, this is still an instructive finding because it suggests that coaching life skills is both a mindset and a specific learning activity that has lifelong benefits.

6.2 Lifelong Learning Enhances Teenagers' Life Skills with AI Technology

It is worth noting that students spend most of their time in school. Apart from extracurricular sports activities and physical education classes, students spend most of their time in the classroom. Therefore, classroom learning is also an excellent opportunity to cultivate students' life skills so that they can better develop their communication skills, absorb novel cognitive frameworks, and develop problem-solving abilities and life from different angles. The following are some effective strategies and ways that could be implemented to facilitate key life competencies through classroom learning.

There is no doubt that AI technology has a brilliant influence on tailored learning and high-quality teaching in the field of education. It is famous that immersive learning is a strategy that allows students to personalize scenes with characters interacting in full-view learning environments [15]. Enhancements to XR, 3D graphics, and wearable gadgets may improve learning performance, and they are highly associated with immersive affection, which generates students' academic achievement and favorable impressions such as excitement, enthusiasm, and engagement [16]. For instance, in an immersive learning environment, students might experience a high level of positiveness because of immersive cooperation via nonverbal communication, gestures, and emotions [17]. At the same time, improving enthusiasm can also promote children's creativity. Taking advantage of immersive learning could also reduce students' sense of fearing difficult subjects and technical ideas when they encounter simulated computer and technology problems, so students may prefer to learn how to solve problems instead of avoiding them. Secondly, Gamification has become a crucial theoretical concept in the field of education to build up students' life skills. The most useful educational games seamlessly incorporate pedagogical design, domain knowledge, and affection elements into gameplay [16]. AI uses data analytics to assess student performance, provide personalized feedback and recommendations, and help teachers identify students' learning needs [18]. For example, Kahoot! is a game-based learning platform where teachers can create interactive quizzes and quiz games. Students participate from their phones or computers, answering questions correctly related to the knowledge they have learned from class to earn points. Teachers can reward points based on students' performance and interaction given by the game platform in real time, motivating them to perform better in their learning and enhancing teamwork. Therefore, lifelong learning activities with AI technology play a vital role in helping teachers enhance the interest and efficiency of classes. More valuably, it can analyze students' performance and demand; it also encourages students' classroom participation and cultivates their creative

thinking communication skills, cooperation ability, and problem-solving skills which have the benefits of exploring their inherent potential.

7 Conclusion

To sum up, lifelong learning is a transformative framework for equipping teenagers with essential 21st-century competencies, concentrating on AI literacy and life skills. As we navigate a rapidly evolving knowledge society shaped by technological advancements and globalization, it is imperative for young individuals to enhance their competitiveness. Our mixed-methods analysis of educational interventions covering both formal schooling and extracurricular activities demonstrates that lifelong learning not only fosters awareness of the latest developments in AI but also promotes investment in AI literacy education. Additionally, it underscores the importance of practical experiences, such as sports and classroom activities, in cultivating valuable life skills among adolescents. However, AI education platforms often need to collect a large amount of personal data to provide a personalized experience, which may raise concerns about privacy and data security. Students may worry about how their data is used and stored, which may affect their learning experience. Moreover, gamification raises ethical concerns about whether learning should have priority over enjoyment, or whether gameplay should take precedence over education. Therefore, schools are supposed to provide training for teachers to help them use AI tools to identify students' individual needs and provide personalized guidance. Besides, teachers are encouraged to build good relationships with students to better understand their emotional and learning needs. Alternatively, they can cheer students up to engage in group collaboration or discussion and use AI tools to support rather than replace communication between students. More significantly, it is helpful for teachers to acquire interdisciplinary and practical knowledge so that they can become more competitive and improve the quality of teaching. For students, they should actively develop autonomous learning, so that they can proactively set learning goals, use personalized recommendations from AI tools, design learning plans for themselves instead of relying on learning how to use AI tools to save time. What is essential for them is to cultivate critical thinking, which can understand functions and limitations of AI education and evaluate the reliability of information. Government and relevant institutions should formulate clear privacy policies and ensure the safe and transparent use of student data to increase the trust of students and parents. Encourage cooperation between schools, technology companies, and policy-makers to jointly develop and implement AI education and life skills solutions to ensure the effectiveness and sustainability of lifelong learning.

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