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Original Paper

Strategies for Enhancing College Students' Digital Literacy in the Digital Age

Hongmin Fan[1] & Xiaomin Wang[2]

[1] Publicity Department of Jiangsu University, Zhenjiang, Jiangsu, China

[2] School of Marxism of Jiangsu University, Zhenjiang, Jiangsu, China

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Abstract

The advancement of digital technology has catalyzed digital reforms in the education sector and upgraded the structure of talent demands. Therefore, it is crucial to enhance college students' digital literacy in the digital age. This paper begins with analyzing the definition of digital literacy, and then introducing the significance of cultivating college students' digital literacy. But there are some challenges in the cultivation of digital literacy among college students, hence this paper analyzes these challenges and proposes four suggestions: promoting the development of digital infrastructure in education, implementing digital literacy training, incorporating digital literacy into the curriculum, and motivating students to consciously improve their digital literacy.

Keywords

College Students' Digital Literacy, Digital Age, Challenges, Strategies

1. Introduction

Currently, a new wave of industrial and technological revolutions is rapidly advancing, with digital technologies such as artificial intelligence and big data continuously making new strides. The promotion of digital literacy is a priority for most information societies, as they become highly dependent on digital resource. (Miranda, Pedro, & Sara, 2018) This transformation necessitates a higher standard of comprehensive competence from individuals. An increasing number of professions not only require specialized knowledge and skills in specific fields but also the ability to efficiently utilize digital technologies. Consequently, there is an urgent need for high-level, innovative, and versatile digital talents to drive digital transformation. Enhancing digital literacy is not only a response to adapting to the digital environment and keeping pace with the times but also a crucial aspect of cultivating digital talents.

2. The Definition of Digital Literacy

In the digital era, understanding the connotation of digital literacy is the key to strengthening the cultivation of college students' digital literacy. This concept is continually evolving and is interpreted differently depending on multiple perspectives. Its earliest proponent was the Israeli scholar Eshet-Alkalai (1994). He clearly proposed that digital literacy is the ability to survive in the digital age, including the use of software or operations. The capabilities of digital devices and complex social skills such as cognition and emotion that can effectively play a role in the digital society. (Eshetalkalai, 2004) Wan N categorizes digital literacy into three intersecting dimensions: the technical dimension, the cognitive dimension, and the social-emotional dimension. (Wan, 2012) Martin defines digital literacy as "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action and to reflect upon this process." (Martin, 2005) Miranda proposes "a threefold definition of digital literacy: access to technology, operational competences and conceptual skills." (Spires, 2022) Hiller Spires classify digital literacy into three stages based on cognitive and social processes: "locating and consuming digital content," "creating digital content," and "sharing digital content." They also highlight that critical thinking is a skill that underpins each of these stages. (Spires, Bartlett, & Garry, 2012) Overall, digital literacy refers to the ability to integrate technology, cognitive skills, and emotional competencies effectively.

2.1 Technological Literacy

Fundamental technological literacy is a core element for college students, serving as a cornerstone for their academic pursuits and future professional endeavors. This includes proficiency in using various digital devices and software, such as smartphones, computers, and tablets, as well as common office applications and social media platforms. Students need to learn how to effectively acquire, process, analyze, and disseminate digital information, which is essential for both academic research and daily life, and develop the ability to use digital technology to solve problems.

2.2 Cognitive Ability

Acquiring advanced cognitive abilities is also essential for college students. In a digital environment characterized by an overwhelming and dynamic volume of information, the capacity to discern the authenticity of information and extract valuable content from the vast array of data necessitates critical thinking ability, logical reasoning, and problem-solving capacity, as well as other related cognitive abilities.

2.3 Emotional Attitude

College students should adopt a proactive and rational perspective towards digital technologies, recognizing both the conveniences and opportunities they afford, as well as the underlying risks and challenges. Moreover, a sense of digital citizenship is important, which involves adhering to legal norms and regulations, preventing the dissemination of harmful content and etc. This approach ensures

the maintenance of a healthy and secure digital ecosystem, thus positioning students as responsible digital users.

3. The Significance of Cultivating College Students' Digital Literacy in the Digital Age

3.1 Adapting to the Needs of the Digital Society

With the rapid advancement of information technology, the digital tools exert profound impacts on all sectors of society. Digital literacy constitutes a valuable asset for students, as it equips them with the necessary skills to fully engage in societal, cultural, and professional domains within an increasingly digitized environment. (Marcut & Soproni, 2012) Digital tools, such as smartphones and computers, have fundamentally changed all fields of social production, becoming indispensable in social interactions, shopping, entertainment, education, and etc. The escalating digitization of society becomes clear in the variety of concepts that are adopting the "e" of electronic as a prefix, such as e-Learning, e-Health, or e-Government. (Anthonysamy, Koo, & Sh, 2020)

Digital literacy has emerged as a core competence in the digital society, representing an essential skill for citizenship and a crucial skill for the development of the digital society. In the context of the digital age, information is witnessing an explosive growth and rapid updates. Students with digital literacy are better equipped to efficiently sift through and utilize information resources, thereby enhancing their learning efficiency and quality. In addition, the widespread proliferation of digital technologies offers students a diverse array of learning platforms, such as online education and virtual laboratories. However, this also requires higher demands on students to continuously improve their ability in applying digital technologies effectively. Consequently, it is crucial to accelerate the enhancement of digital literacy among college students, in order to cater to the requirements of the digital era and prepare for future challenges.

3.2 Promoting Digital Citizenship and Ethical Behavior

In the context of the digital age, cultivating digital literacy among college students is not only crucial for enhancing their personal skills but also exerts profound significance in promoting the overall societal digital citizenship and ethical behavior. Digital literacy, as the capability of individuals to effectively acquire, understand, assess, create, communicate, and solve problems with information in a digital environment, constitutes the foundation of digital citizenship and ethical behavior. College students with well-developed digital literacy are better equipped to engage rationally in digital interactions, discern the authenticity of information, and extract valuable information. Through systematic digital literacy education, students can enhance their awareness of digital security, such as avoiding blindly trusting unverified online information and refrain from casually disclosing personal information. College students can develop the awareness of actively engaging in the purification and maintenance of the online environment, thereby contributing to the creation of a safer and healthier digital ecosystem.

3.3 Enhancing Professional Competitiveness in the Workplace

In the contemporary era, digital literacy extends far beyond the simple acquisition of digital skills, which were previously confined to the comprehension of hardware and the utilization of software. Today, digital literacy should be regarded as a comprehensive set of competencies essential for navigating modern society. Specifically, these competencies include the knowledge, skills, and behaviors required for effective engagement with digital technologies and intelligent devices, such as smartphones and laptops, to facilitate collaboration, communication, and support. (Novella-García, & Cloquell-Lozano, 2021)

3.4 Cultivating Critical Thinking and Problem-Solving

Digital technologies have not only brought numerous conveniences to college students but also profoundly influenced their cognitive method. Artificial intelligence, characterized by its expediency, accessibility, and convenience, endows students with a number of advantages. However, concurrently, excessive reliance on AI in learning diminishes their critical thinking and innovation capabilities. For instance, many students use ChatGPT to assist in writing their academic papers. In this process, AI plays the role of a knowledge provider, while students become passive recipients of knowledge. This unidirectional mode of knowledge transmission hinders the development of students' critical thinking and innovation abilities.

Furthermore, as the issue of "fragmentation" of digital information becomes increasingly prominent, the challenge for college students lies in accurately discerning and identifying valuable information within the plethora of fragmented digital information, and breaking out of the "Information Cocoons". This necessitates a higher demands of information literacy for college students. Therefore, it is of importance to guide college students in developing a correct value on digital information, enhancing their digital thinking abilities and skills, which is conductive to foster their critical thinking and problem-solving capabilities.

4. Current Challenges in Cultivating Digital Literacy Among College Students in the Digital Age

4.1 Disparities in Digital Resource Educational Allocation

Initially, due to the limitations imposed by the local levels of economic development, there exist disparities in the digital infrastructure among colleges. Colleges in economically developed regions exhibit significant advantages over those in less developed areas in terms of accessing digital resource platforms, constructing digital infrastructure, and updating information technology equipment. Some colleges, backed by substantial financial support and strategic planning, have developed the advanced information technology platforms, intelligent teaching systems, extensive online course repositories, and efficient data analysis tools. These advancements facilitate the innovation of teaching methodologies and the enhancement of learning efficiency. Conversely, colleges in remote areas are lagging behind due to constraints such as financial scarcity, delayed technological upgrades, and a shortage of specialized talent. As a result, their digital education infrastructure is relatively

underdeveloped, leaving students with limited access to high-quality online educational resources and teachers facing challenges with inadequate teaching tools and limited assessment methods.

4.2 Weak Awareness of Improving Digital literacy Among College Students

Some students view digital technology merely as a tool for entertainment or social interaction, failing to recognizing its function in educational and professional contexts. This reflects an insufficient awareness of the importance of digital literacy, and results in insufficient lacking of proactive efforts to enhance it, which is primarily manifested in the inefficient utilization of digital tools and resources. Although digital technology has provided students with a favorable learning platform, many students place greater emphasis on its entertainment aspects. A considerable number of college students are addicted to online games or content with a preference for fragmented, superficial reading, passively consuming digital content without engaging in critical analysis.

Moreover，due to the absence of learning objectives and planning in their self-directed learning process, college students are prone to getting lost in the digital environment. This deficiency in self-regulation gradually diminishes their capacity for self-monitoring, rendering them increasingly susceptible to distractions in the online realm and contributing to the emergence of phubbers.

4.3 Outdated Educational Content in the Digital Realm

As the cutting-edge technologies of artificial intelligence, big data, and cloud computing continue to evolve at an unprecedented pace; they are not only reshaping the landscape of social, but also placing increased demands on the knowledge structures, skill requisites, and innovative capacities of undergraduate students. Unfortunately, curricula and course materials often struggle to swiftly capture and integrate these rapidly emerging technological advancements, resulting in limited enhancement of students' digital literacy in educational settings. Additionally, some educators have yet to develop a scientific understanding of digital literacy, which negatively impacts students' digital competencies. For instance, some instructors cling to outdated perspectives and do not fully comprehend the benefits and efficacy of digital teaching methods, which results in a reluctance to adopt such practices. Others may be constrained by their own limitations in digital application skills, finding it difficult to adapt to the digital teaching.

4.4 The Overwhelm of Excessive Digital Information

Confronted with the overwhelming abundance of digital resources, certain college students demonstrate a deficiency in both proactive exploration and deep learning, frequently content with superficial engagement or passive acquisition of knowledge, which impedes the elevation of their digital literacy. Simultaneously, the distinctive fragmentation of digital information is becoming increasingly pronounced, necessitating students to sift and distill valuable content. This task imposes even more rigorous requirements on their digital literacy.

The widespread application of big data and personalized algorithmic technologies, which recommend content based on users' browsing histories and preferences, make information available for people. However, this also inadvertently constructs information cocoon, restricting students' exposure to

diverse viewpoints. Gradually, such an information environment could narrow their cognitive horizons, hindering the development of critical thinking ability. This presents a potential challenge to the cultivation of versatile talents equipped to meet the demands of the evolving societal landscape.

5. Strategies for Enhancing College Students' Digital Literacy

5.1 Promoting the Construction of Digital Infrastructure in Education

To enhance college students' digital literacy, it is essential to provide accessible digital facilities. It is clear that sufficient ICT infrastructure will become a key framework factor, which automatically implies the need for targeted efforts to overcome digital literacy issues, both at the individual level and at the level of society and its educational institutions. (Novella-García & Cloquell-Lozano, 2021) However, some colleges still face challenges related to inadequate digital infrastructure. The government should offer financial and policy support for colleges to enable colleges to invest in high-quality infrastructure, optimize the construction of campus networks, data centers, and one-stop service platforms, and thus create a more convenient learning and living environment for students.

Furthermore, colleges should introduce intelligent teaching facilities and develop online collaboration platforms to break through spatial and temporal constraints, thereby facilitating the sharing of knowledge. Government can encourage colleges to engage in project collaboration with enterprises and research institutions, focusing on emerging issues within the digital domain. By collaboratively undertaking research projects and co-filing patent applications, students' research skills and teamwork capabilities can be enhanced, thereby better preparing them for the competitive workforce.

5.2 Implementing Digital Literacy Training

Training is regarded as an effective way to improve digital literacy. Firstly, it is necessary for the government to increase its both policy and financial support for digital education and training initiatives. For instance, the "Skills Future" project launched by the Singaporean government in 2015 aims to equip individuals with skills necessary for maintaining competitiveness in the global job market. It states that "about 87% of the 57,000 trainees surveyed in 2020 indicated that they were able to perform their work better after undergoing SSG-funded training, a slight improvement from 86% in 2019". (Skills future Singapore, 2020)

Secondly, colleges should customize digital literacy training to align with the specific characteristics of students' majors, their individual needs, and the requirements of the labor market, cultivate students' practical application ability, and make students realize that digital technology, as a powerful tool, can assist them in acquiring information, efficiently complete tasks, and expanding their knowledge base. Such preparation will enable students better meet the needs of the job market. In addition, the standard for talent assessment should be redefined. Traditional evaluation methods, which focus primarily on grades, are no longer adequate to meet the demands of the evolving era. In the digital age, colleges should take into account the characteristics and requirements of this new era, emphasizing the development of students' cognitive skills, innovative ability, critical thinking, and independent think

ability. This approach is essential for nurturing high-caliber professionals who are well-equipped to thrive in the contemporary landscape.

Moreover, we should also pay attention to the guiding role of teachers in students, provide training for teachers to strengthen their digital literacy. Digital teacher competencies are "the set of skills, attitudes and knowledge required by educators to support student learning in a technologically rich world, design and transform classroom practices and enrich their own professional development". (Esteve-Mon, Llopis-Nebot, & Adell-Segura, 2020) In the current context of rapid digital development, facing the new generation of "digital natives" college students, teachers should transform from the role of "teacher" to "guide", and pay attention to students' digital ethics and morality. (Yu, Xue, & Chao, 2020)

5.3 Incorporating Digital Literacy into the Curriculum

Colleges play a crucial role in fostering digital literacy among college students. In 2019, the European University Association released the report "*Digital Skills: Where Universities Matter*," which emphasizes the significance of colleges in the education of students' digital literacy. It states that the unique responsibility of colleges lies in cultivating experts for future digital transformation and in producing highly skilled graduates in the digital transformation era. (Jorgensen, 2021) Firstly, higher education institutions should tailor digital literacy development objectives based on the learning characteristics of students in different academic years and the traits of various disciplines, with a focus on practical realities to enhance the targeted effectiveness of digital literacy education.

Secondly, the content of digital literacy education should be integrated into the curriculum system of talents training in different majors, so as to achieve the organic integration of digital literacy and professional learning, and use digital literacy to assist and solve professional problems. (Huang, Xu, Sang, & Shao, 2023) Specifically, colleges should take information technologies such as the internet and artificial intelligence as the core, optimize academic programs, and proactively introduce related majors such as robotics engineering and big data technology. Additionally, it is crucial to accelerate the deep integration and innovative development of digital technology with education. This can be achieved through the adoption of digital teaching methods, including mobile technology, the internet, virtual reality, and human-computer interaction, thereby, enhancing the integration of digital literacy into educational practices.

5.4 Motivating Students to Consciously Improve Their Digital Literacy

In the process of digital literacy education, it is essential to fully stimulate the intrinsic motivation for learning among college students, mobilize their enthusiasm in learning, and enable them to play a leading role in the digital literacy training.[11] We can assist students in recognizing the profound importance of cultivating the digital literacy. Media platforms, such as official Douyin accounts and WeChat public accounts, can be effectively utilized to advertise the concept or function of digital literacy that attract widespread attention and engagement. Students can also be encouraged to actively participate in digital skills training, technological innovation activities and etc. In the process of using

digital technologies, independent thinking ability and critical thinking can empower students to navigate digital landscapes more effectively and make informed decisions.

Additionally, educational activities should be held for college students to guide them to comply with laws and regulations, identify information on the internet, and strengthen their digital security awareness. By organizing digital science popularization activities and competitions, it is effective to invigorate the development of campus digital culture. For example, hosting lectures on digital technologies can inform both faculty and students about the latest advancements in digital science and technology. Concurrently, the establishment of a digital education platform for college students, which provides diverse digital learning resources, facilitates the provision of accessible learning avenues. This, in turn, fosters a positive campus cultural atmosphere. Appropriate incentive measures, such as incorporating digital literacy competitions into award evaluation system, can also be adopted to stimulate the enthusiasm and creativity of college students, making them more consciously involved in the process of improving digital literacy, ultimately cultivating highly skilled and qualified talents for the future digital society.

6. Conclusion

With the application and proliferation of digital information technologies, the cultivation of digital literacy in higher education plays a crucial role in advancing the digital transformation of education and fostering innovations in educational concept. However, it also faces some challenges: disparities in digital resource educational allocation, weak awareness of improving digital literacy among college students, outdated educational content in the digital realm and the overwhelm of excessive digital information. This paper proposes strategies for cultivating college students' digital literacy from three perspectives: government, institutions, and students. From the governmental perspective, increasing investment in digital education resources, enhancing digital infrastructure, and providing specialized training are crucial for creating a supportive external environment and resource conditions for developing students' digital literacy. At the institutional level, it is necessary to optimize curriculum design and implement diverse digital literacy education activities to offer robust educational support and motivation for enhancing students' digital literacy. Regarding the students, there is a need to reinforce the consciousness of self-improvement, proactively engage in various digital literacy training activities, and continuously strive to enhance their competitiveness in the digital era.

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