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Cultivating Digital Literacy among College Students Connotations, Dilemmas, and Pathways

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Abstract:
Digital literacy is a foundational capability for college students to participate in the production and daily life of a digital society, and it also represents a key component of talent development in higher education. This paper first clarifies the basic connotations of student digital literacy, then systematically examines four major challenges currently facing digital literacy education. These are:a mismatch between cognitive awareness and practical skills,which leads to an imbalanced literacy structure;instructional models that lag behind the evolution of digital technologies,resulting in limited educational effectiveness;external digital environments and individual behavioral habits that reinforce each other, thereby increasing learning inertia; and vague ethical awareness and unclear responsibility boundaries, which weaken the possibility of steering technology toward positive social purposes. In response to these issues, the paper proposes an integrated cultivation framework that combines coordinated development, pedagogical restructuring, environmental governance, and ethical regulation. The goal is to shift digital literacy education for college students from a purely skills-oriented approach toward one guided by values, so as to achieve a meaningful integration of instrumental rationality and value rationality.

Keywords:
college students;digital literacy;digital education; digital ethics; literacy cultivation

1. Introduction

Digital technologies, particularly artificial intelligence, are profoundly reshaping how society produces and how people live, pushing us into a new era defined by digitalization and intelligence. These technologies have not only driven industrial upgrading but have also brought about challenges such as internet addiction, information cocoons, and ethical misconduct, which in turn place higher demands on the capabilities of all members of society. As a result, digital literacy has become an essential component of the core competitiveness of modern citizens. The Chinese government has placed great emphasis on fostering digital literacy. In 2022, four central departments, including the Cyberspace Administration of China, jointly issued the“Action Outline for Enhancing Digital Literacy and Skills of the Entire Population”, which laid out a comprehensive interpretation of digital literacy and an overall plan for its promotion. The 20th National Congress of the Communist Party of China also identified the enhancement of public digital literacy as a critical element in building Digital China. College students are a vital force in realizing Chinese-style modernization; they are key workers driving the development of new quality productive forces and a central pillar in the construction

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of Digital China. That said, compared with developed countries, China started later in cultivating digital literacy among its university students.There remain issues such as inconsistent understandings of its connotations, inadequate cultivation models, and weak ethics education, all of which call for further exploration at both theoretical and practical levels. This paper, after systematically reviewing the definitional landscape, proceeds to analyze the current dilemmas in depth and then offers targeted practical pathways. It is hoped that this discussion will serve as a useful reference for deepening digital literacy education and for preparing a new generation of digitally competent talents capable of shouldering the responsibilities of the nation's rejuvenation.

2. The Basic Connotations of Student Digital Literacy in the New Era

The definition of digital literacy has gradually shifted from being mainly based on technical tools to a more comprehensive understanding that encompasses humanistic dimensions. Paul Gilster, who first proposed the term, initially defined it as the ability to understand and use digital resources and information presented by computers. This definition was almost entirely focused on the tool operation level in the early stage. Subsequently, the European Union described digital literacy as the ability to use information technology confidently, critically and creatively in work, employment, study, leisure and social engagement.[1]On this basis, UNESCO has further expanded this definition, defining it as the ability to appropriately acquire, process, analyze, synthesize, evaluate and create information with the aid of digital tools and information resources. In domestic research, Xiao Junhong was among the first to point out that digital literacy is comprehensive and complex, involving multiple dimensions such as cognition, emotion and social skills. In 2021, the Central Cyberspace Affairs Commission issued the Action Plan for Enhancing the Digital Literacy and Skills of All Citizens, providing for the first time a comprehensive and clear official definition: Digital literacy and skills refer to the collection of a series of qualities and abilities that citizens in a digital society should possess for learning, working and living, including the acquisition, production, use, evaluation, interaction, sharing, innovation, security guarantee, ethics and morality of digital data. [2] As time goes by, the connotation of this concept has become increasingly rich, and its extension has also continued to expand.

Based on the above definition, college students' digital literacy can be understood as:Based on establishing correct digital values and adhering to the concept of technology for good, college students acquire cutting-edge digital knowledge and diverse digital skills through systematic learning. They then apply critical thinking to integrate intelligent technologies and services into various digital practices such as smart learning, skill practice, scientific research, innovation and entrepreneurship, and digital communication. The core objective of this ability is to help students form a stable subjective cognition and consistent behavioral tendency towards themselves and the digital world. Through targeted skills training and relying on their existing knowledge and experience, they gradually develop intellectual activity patterns that adapt to specific digital environments. According to the theory of human ability by Marx and Engels, the digital literacy of college students is essentially an inner potential formed on the basis of innate endowment and acquired later in life. It is an important way for individuals to demonstrate their essential power in object activities. Its internal structure consists of three fundamental elements: knowledge, skills and attitudes, which respectively provide the information premise, the experience basis and the emotional regulation function. The three are interrelated and work in synergy, jointly forming a dynamic organic whole.

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3. Real World Challenges in Student Digital Literacy Education

The deep integration of digital technology has made digital literacy an essential ability for contemporary college students to participate in social and economic activities. According to the 53rd statistical report of the China Internet Society, as of December 2023, the number of Internet users in China has reached 1.092 billion, with an Internet penetration rate of 77.5%[3].The mainstream survival mode in contemporary Chinese society has shifted towards digitalization. Digital literacy runs through the entire process of students' learning and growth, including knowledge acquisition, information exchange, tool application, and value judgment. However, the actual implementation of digital literacy education for college students at present is confronted with multiple structural predicaments, which can be examined from four specific aspects.

3.1 Mismatch Between Awareness and Ability, and Narrow Application That Hinders Literacy Improvement

The primary difficulty in students' digital literacy education lies in the significant disconnection between the awakening of awareness and the cultivation of skills. Students tend to be overly confident in their assessment of digital abilities, yet their actual performance fails to meet expectations.This indicates that digital literacy education is still at the stage of superficial cognition and has not yet been transformed into substantive ability improvement. In terms of knowledge acquisition, the range of digital resources that students rely on is relatively narrow.Most students are accustomed to using mainstream search engines such as Baidu to obtain subject-related information, while the usage rates of professional platforms like the National Smart Education Public Service Platform, China National Knowledge Infrastructure (CNKI), and academic official wechat public accounts are significantly lower. Although university libraries are constantly increasing their investment in digital resources every year and their digital collections are becoming increasingly rich, these resources have not yet become a regular way for students to search for knowledge on a daily basis. Critical thinking is a kind of insight, discrimination and judgment - a mental activity and emotional state by which people analyze and grasp the essence of things [4]. According to data from iiMedia Research, in 2021, 33.7% of college students in China spent more than six hours a day on their mobile phones [5]. Without the guidance of critical thinking, students are in a passive and blind state in the acquisition of digital knowledge. They remain at the superficial level of searching for what is needed, neither developing disciplinary awareness and methodological understanding nor establishing an information retrieval and screening system suitable for professional learning. Meanwhile, many students lack the ability to systematically integrate digital resources. Scattered and fragmented information sources prevent it from constructing a clear and coherent knowledge graph, thereby restricting the development of deep learning and complex problem-solving capabilities. The integration of digital literacy education and professional knowledge systems is still insufficient. At present, the cultivation of digital literacy in most colleges and universities mainly relies on elective courses in literature information retrieval or orientation for freshmen, and has not yet formed a systematic and full-cycle teaching framework. As a result, students lack the opportunity to repeatedly apply and test their digital skills in real professional contexts. Their digital literacy has long remained at the level of general ability and is difficult to be transformed into professional qualities that can deal with real-world problems.

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3.2 Disconnect Between Teaching and Learning, and Institutional Weaknesses That Weaken Educational Outcomes

At present, there is a significant mismatch between the supply of digital literacy education and the actual needs of students, and this contradiction weakens the effectiveness of teaching. The problems mainly focus on three aspects: the overall training framework, the design of the curriculum system, and the construction of the teaching staff. Some universities have not yet integrated digital literacy education into the overall strategic framework of the country's digital transformation, nor have they formulated special implementation plans or corresponding institutional guarantee mechanisms. Departments within the school, such as the Information Center, the Academic Affairs department, the student affairs system, and the Communist Youth League organization, often operate independently, lacking data sharing and collaborative interaction. The content of the general digital courses offered by the academic affairs department does not have a high degree of alignment with the actual demands of future employment. The information technology department is mostly busy with daily technical maintenance and less deeply involved in teaching design. When organizing campus activities, the student affairs system makes limited use of digital tools and fails to transform extracurricular practices into effective carriers for enhancing digital literacy. As a result, the collaborative efforts of multiple departments have not yet coalesced into a unified force for cultivating students' digital capabilities.

In terms of curriculum design, digital literacy education is still disconnected from professional core courses largely. Most related courses are offered in the form of independent general education modules and lack substantive integration with the subject content. Meanwhile, the curriculum system lags behind the rapid pace of technological iteration, and what students learn often fails to match the actual demands of the industry. Teaching focuses on theoretical instruction and basic operation practice, with relatively weak practical links. Project-based learning, problem-driven and other teaching models have not yet been widely implemented. In addition, digital tools are rarely substantially integrated into professional courses, and traditional lecture-based teaching dominates. Students have insufficient opportunities to conduct exploration and innovative practices using digital technologies. Under such conditions, it is difficult for digital literacy and professional ability to form a mutually reinforcing virtuous cycle.

At the teacher level, a teacher's own digital competence is directly related to the quality of teaching. Chinese leaders have emphasized that educators should firmly establish the awareness of reform and innovation, actively participate in innovative teaching practices, and contribute to promoting the construction of a world-class modern education system with Chinese characteristics. This discussion points out a clear direction for the professional development of teachers. However, in the current context of higher education, there are still many obstacles to enhancing teachers' digital literacy. Some teachers have limited awareness of ethical risks such as data privacy and algorithmic bias. They often merely view digital technology as an auxiliary means to traditional teaching and fail to fully recognize its potential power in driving fundamental changes in teaching methods. As a result, teachers lack the willingness and ability to actively integrate digital tools into their curriculum design. At present, most training programs for teachers focus on basic operational skills, while there is insufficient coverage of advanced topics such as digital ethics, data security, and the in-depth application of intelligent teaching tools. Moreover, the training content tends to be homogenized and fails to be distinguished according to different disciplinary backgrounds. Meanwhile, the assessment and evaluation system

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of colleges and universities has not yet given appropriate weight to digital teaching ability. The current performance indicators still center on traditional dimensions such as class hours, research achievements, paper publications and patents, lacking an effective incentive mechanism to encourage teachers to carry out digital teaching innovation.

3.3 Mutual Influence Between Environment and Behavior, and How External Disorder Exacerbates Internal Inertia

Students' digital literacy education takes place in a highly complex digital ecosystem. At the environmental level, the wide adoption of algorithmic recommendation technology has fundamentally changed the way students receive information. The algorithm pushes content based on users' preferences, trapping students in an information cocoon and exposing them to only a narrow range of similar viewpoints for a long time. The black box nature of algorithm operation makes content distribution opaque and fragmented, and the tension between instrumental rationality and value rationality is becoming increasingly prominent. What students are confronted with is not only the narrowing of information sources; The deeper danger lies in the fact that cognitive processes such as analysis, comparison, questioning and synthesis are being quietly outsourced to algorithms, thereby continuously eroding their systems thinking and independent judgment capabilities. Meanwhile, the consumerist logic of the platform economy, through algorithmic recommendations, precisely delivers commercial content to students, subtly shaping their value orientations.

At the behavioral level, students' digital participation shows a distinct fast food-like feature. Many students mainly use digital devices for entertainment and relaxation, thereby reducing their attention to observing and reflecting on the real world. They have little willingness to explore the deep logic of complex social issues. In the diverse virtual and real communities they inhabit, the student group differentiates into subcultural circles with clear hierarchical structures. There is significant homogeneity within the circle: communication tends to reinforce existing positions, while cross-circle interaction continues to decline. Mobile intelligent devices occupy a considerable proportion of students' cognitive resources, thus reducing the time and mental space available for in-depth reading and continuous reflection. Meanwhile, face-to-face offline communication has gradually been replaced by online interaction, thereby weakening the embodied social experience.

The interaction between the environment and behavior has given rise to a phenomenon that can be called the passivation effect. Once the brain ADAPTS to fragmented information patterns, it tends to pursue immediate stimulation and avoid professional learning and innovative practices that require long-term investment. Furthermore, virtual experiences are increasingly eroding the perception of physical reality. Students' excessive reliance on digital tools is drifting further and further away from hands-on training and physical Spaces. Its reliance on two-dimensional screens weakens spatial imagination and perceptual acuity, thereby reducing intuitive judgment and creative thinking that usually arise from the interaction between the body and the world.

3.4 How do ambiguous values and responsibilities, as well as weak ethical foundations, undermine the positive potential of technology

At present, digital literacy education is relatively weak in terms of value guidance and ethical shaping,

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resulting in an imbalance between technical training and value cultivation. When the improvement of technical capabilities lacks clear values and ethical norms to support it, digital literacy may degenerate into mere operational skills, losing the humanistic spirit and moral connotation that the term literacy should carry. Digital alienation is interfering with students' meaning construction in their digital activities. The cognitive closure brought about by the information cocoon gradually erodes its ability to make autonomous choices in algorithmic recommendation systems. When confronted with pre-screened content, students tend to reinforce their existing positions, which may in turn lead to group polarization. The lack of contact with heterogeneous viewpoints makes it easier for emotional outpouring and extreme thinking to spread. There is a structural tension between the instrumental rationality contained in algorithmic recommendation and the value rationality advocated by digital literacy education: the former is dedicated to user retention and attention capture, while the latter focuses on the cultivation of independent judgment and critical reflection. These two forces have been interwoven for a long time, causing students to be confused and uncertain about their own values.

At the level of responsibility, students' awareness of digital responsibility remains rather vague. Many students agree with the abstract concept of promoting public welfare through technology, but when it comes to specific issues such as intellectual property protection, personal data management and the identification of the ethical boundaries of technology, their understanding often remains superficial. Some students fail to actively distinguish the authenticity of digital information and frequently forward online rumors. What's more, some people take advantage of the anonymity of virtual Spaces to evade responsibility and carry out improper behaviors such as human flesh search and online abuse. The causes of these problems lie in the weak awareness of digital responsibility, the absence of ethical education, and the disconnection in the perception of responsibility between virtual and real environments.

At the level of moral development, digital ideological risks pose a continuous challenge to students' value recognition. Rumors, false information and extreme viewpoints are precisely pushed to the student group, making it difficult for them to distinguish truth from falsehood in the complex online environment. Over time, they gradually accepted what the algorithm repeatedly presented and no longer questioned it. When students' technical operation skills surpass their moral judgment and ethical self-reflection abilities, technology may instead become a booster for misconduct rather than a binding force. If digital literacy education fails to make substantive progress in the ethical dimension, the educational goal of technology for good will remain merely a superficial slogan.

4. Cultivation Pathways for Student Digital Literacy

4.1 Collaborative Enhancement of Digital Literacy and Practical Competence

Transforming learning outcomes into practical application skills is a key link in enhancing college students' digital literacy. Data released at the Adobe MAX Conference in 2021 shows that graduates with digital creative skills are expected to have a starting salary 16% higher in their first job, and their subsequent salary growth rate is three times that of their peers [6]. To narrow the gap between cognition and application, systematic improvements are needed in aspects such as curriculum design, talent cultivation models, and real-world practical environments. At the curriculum level, a group of digital literacy modules should be set up

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between general education and specialized courses to build a curriculum system that combines basic knowledge with application and deeply integrates digital knowledge with professional content. In terms of teaching methods, Project-Based Learning and Problem-Based Learning models should be adopted. Through real cases and scenario simulations, students should be guided to understand and apply digital tools in the process of solving practical problems. This will shorten the distance from knowledge acquisition to skill application. In the practical aspect, universities can expand internships, practical training and innovation and entrepreneurship activities integrated into digital work processes through industry-education integration or simulated environments, allowing students to be exposed to real or simulated digital work scenarios. According to the Survey Report on the Development of Digital Literacy and Skills for All (2024), among people aged 18 to 29, the proportion of those with digital literacy and skills at the primary level or above is 75.76%[7]. For students who already possess strong information technology capabilities, advanced modules such as algorithm design and data analysis can be added to further enhance their innovation capabilities and build a hierarchical and progressive development path. During this process, courses should shift from subject-oriented to application-oriented, teaching should change from one-way lecturing to task-driven collaboration, and students should transform from passive recipients of information to active participants in digital practice. Ultimately, digital literacy should serve as a reliable foundation for students to discover, analyze and solve problems in their studies and careers.

4.2 Reconstructing Digital Teaching Models Toward Greater Interactivity

At present, digital literacy education in colleges and universities often overly relies on one-way indoctrination teaching. This current situation requires us to reflect from multiple dimensions such as course content, teaching forms and teachers' capabilities. At the content level, it is necessary to face up to the current problem of the disconnection between digital literacy cultivation and subject education, rather than separating the two. The constituent elements of digital literacy should be organically integrated into the curriculum systems of various majors. For instance, in the fields of science and engineering, practical links in data processing and analysis can be added. In the field of humanities and social sciences, digital tools for literature review and text analysis can be introduced. In this way, students can develop digital skills while learning professional knowledge. This not only enhances the pertinence of learning but also promotes the effective transfer of skills to new situations. In terms of teaching forms, colleges and universities should guide students to think independently and play a more active role in the development process of digital literacy. While cultivating technical capabilities, it is also necessary to establish correct digital values [8]. Although the lecture method still has its value, it should be combined with other teaching methods. For instance, students can be required to complete a series of tasks that comprehensively apply various skills such as information retrieval, data processing and result presentation, so that these abilities can be integrated and internalized in practical exercises. The role of teachers in this process is particularly crucial because they shoulder the heavy responsibility of shaping the thoughts of the next generation [9]. Teachers' own digital literacy and teaching concepts are the foundation of any reform in teaching models. Colleges and universities can help teachers update their knowledge reserves and master emerging tools by setting up systematic training programs. Meanwhile, by means of evaluation and incentive mechanisms, teachers are encouraged to incorporate more interactive and practice-oriented teaching elements into their course designs. The ultimate goal is to enable teachers to possess the corresponding judgment and practical abilities, allowing them to naturally integrate digital elements into

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their respective teaching contexts.

4.3 A Mutually Reinforcing Mechanism Between Digital Environment Governance and Individual Self Discipline

Cyberspace has a significant impact on people's behavioral patterns. Therefore, the cultivation of digital literacy should be carried out in a two-pronged manner: it is necessary to improve the external environment as well as enhance individuals' internal capabilities. For college students, their digital environment is composed of campus network infrastructure, accessible digital resources, the quality of content on various platforms and usage rules. At present, the National Smart Education Public Service Platform provides abundant digital resources for online learning. According to statistics, the platform offers over 31,000 higher education courses and more than 2,000 lifelong learning courses [10]. The above factors jointly shape the digital way of life of college students. However, the effectiveness of environmental governance depends on whether people are willing to accept and respond to relevant norms. If external regulations and resource input are not actively absorbed by individuals and transformed into their own behavioral norms, their influence will be greatly reduced. Students' autonomy, self-control and information discrimination ability directly affect their actual effect of absorbing positive factors and filtering negative ones from the digital space. The cultivation of self-discipline not only depends on formal education but also on an individual's internal self-supervision. To address the information cocoon effect caused by algorithmic recommendations, students need to cultivate the habit of actively searching for and cross-verifying information through multiple channels. To cope with the continuous consumption of attention by fragmented information, students should consciously arrange time for in-depth reading and focused study. Environmental governance and individual self-discipline are not a one-way causal relationship, but rather a dynamic process of mutual influence and adjustment. A well-designed institutional framework and high-quality environmental conditions can provide a clear reference system and behavioral support for self-regulation. At the same time, when a large number of self-disciplined individuals act rationally in the digital space, it also helps to purify the overall environment and reduce governance costs. Conversely, an disorderly environment will weaken an individual's willingness to be self-disciplined, while unrestrained individual behavior will further deteriorate the environment. This indicates that the cultivation of digital literacy should focus on the coordinated efforts of environmental improvement and individual guidance, optimizing external conditions while awakening internal self-awareness, so that the two can reinforce each other in a continuous feedback loop.

4.4 Value Guidance and Responsibility Standards in Digital Ethics

At present, digital ethics education in colleges and universities has deficiencies in both value guidance and responsibility norms, and it is urgent to promote it in a coordinated manner from three aspects: awareness cultivation, responsibility formation and institutional coordination.

Consciousness construction is the core prerequisite. Many college students have not fully recognized the consequences of privacy leakage, lack perception of the harmfulness of online speech, and have a clear understanding of the specific requirements for academic integrity in the digital environment. These cognitive gaps mainly stem from insufficient education rather than moral deficiencies. Therefore, colleges and universities should incorporate digital ethics into the regular content of quality education and promote it through

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methods such as offering general education courses, holding theme class meetings, and organizing case studies. The teaching content should cover aspects such as online privacy protection, digital identity management, fact-checking, online communication etiquette, and the standardized use of academic resources.

The cultivation of a sense of responsibility is at the core of this effort. Digital responsibility is not only about restraining one's own behavior, but also means respecting others' rights and safeguarding public interests. Every post, share or comment may have an impact that goes beyond the individual's scope. As college students with a relatively high level of education, we should clearly recognize these broader influences and take them into account in our actions. The cultivation of a sense of responsibility requires the transformation of ethical principles into concrete practices - verifying facts before re-posting, weighing the consequences before commenting, and following citation norms when using others' achievements. Only in this way can students make correct moral judgments when facing real situations.

Institutional coordination provides an important guarantee for the construction of cyber civilization. China has promulgated laws and regulations such as the Data Security Law and the Personal Information Protection Law, establishing a regulatory foundation for individuals' participation in the digital world. However, systems can only shape behavior and are difficult to fundamentally change people's inner beliefs. The irreplaceable value of moral education lies in bridging the gap between legal norms and individual consciousness. Through subtle cognitive influence, it gradually transforms external norms into endogenous habits. Continuous guidance and value transmission can drive external constraints to transform into long-term internal behavioral norms. When students' understanding of digital ethics shifts from the bottom-line thinking of what not to do to the value thinking of how to do it more appropriately, external rules are no longer pressure but become a conscious reference for action. This transformation from passive compliance to active recognition is an important sign of the maturity of digital literacy.

5. Conclusion

Digital literacy has become both a core capability for individual development and a key dimension of educational evaluation. This paper has revealed four interrelated challenges in cultivating digital literacy among college students: structural imbalance, slow moving teaching practices, the mutual reinforcement of environment and behavior, and weak ethical grounding. The way out lies in moving beyond a narrow skills only approach and embracing a logic that brings together instrumental rationality and value rationality. Through coordinated efforts in collaboration, instruction, governance, and standard setting, students can be guided to develop critical thinking and ethical awareness while mastering technology. Looking forward, digital literacy education should take the comprehensive development of the person as its ultimate aim, seeking a proper balance between technological empowerment and humanistic concern. The goal is to nurture a new generation of talents who combine strong abilities with a keen sense of responsibility, so as to contribute to the building of Digital China and the advancement of new quality productive forces. Achieving this will require continued dialogue and sustained joint work between researchers and educators.

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