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Model of Cultivating Digital Citizenship in Universities through the Integration of Artificial Intelligence and Data Analysis

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Abstract:
The engineering background provides a solid foundation in the field of artificial intelligence, particularly in computer science, mathematics, and electronic engineering. These disciplines offer essential theoretical knowledge and practical skills for algorithm design, model construction, and system implementation in artificial intelligence. College graduates are the future of the nation, and strengthening the cultivation of civic qualities among college graduates is of great practical significance for promoting their physical and mental wellbeing and successful development. This paper analyzes the current state of civic qualities among university students and the necessity of enhancing quality education, exploring methods to cultivate civic qualities in university students in the context of the internet. Focusing on a model for cultivating digital citizenship in universities by integrating artificial intelligence and data analysis, this paper conducts corresponding discussions.

Keywords: internet, artificial intelligence, data analysis, college students, civic awareness, education

INTRODUCTION

Civic awareness is the result of modern constitutional movements and represents a conscious understanding of the legal rights and responsibilities one possesses. Its specific content includes awareness of rights and obligations, rule of law, morality, and contemporary issues, while its extended meanings encompass equality, public spirit, and public morality; a sense of honesty, tolerance, and autonomous rationality. The Seventeenth National Congress of the Communist Party of China proposed ideas regarding democracy, freedom, equality, and fairness. With the advent of the internet era, strengthening the cultivation of civic awareness among college students has become a focus of attention.

With the rapid development of information technology, the world is undergoing a profound digital transformation. The field of education is no exception, and universities, as the cradle of talent cultivation, face the challenge of adapting to this transformation and training talents to meet the demands of future society. Artificial intelligence and data analysis, as hotspots in the current technology field, have not only profoundly changed the development models of various industries but also provided new ideas and methods for talent cultivation in universities. In the digital era, university students, as digital citizens, need to possess the ability to utilize digital technologies and tools for learning, communication, and innovation. However, there are still certain deficiencies in universities' efforts to cultivate students' digital literacy, which fall short of meeting their growing demands. The traditional university education model appears inadequate in addressing the digital transformation, necessitating the introduction of new technologies and methods to innovate educational models.

In recent years, the concept of digital citizenship has been extensively studied. Öztürk [1] and Chen et al. [2] emphasized its multidimensional nature and explored the importance of integrating it into educational environments. Milenkova and Lendzhova [3] and Buchholz et al. [4] studied the role of digital citizenship in addressing social crises, highlighting its evolving significance for humanity. In higher education, Al-Abdullatif and Gameil [5] examined students' practical behaviors, while Tapingkae et al. [6] verified the effectiveness of gamified methods in fostering digital citizenship behaviors. Fernández-Prados et al. [7] developed tools for measuring digital citizenship. In recent years, Pangrazio and Sefton-Green [8] primarily focused on analyzing the intersection of digital citizenship and digital rights. Calzada [9] analyzed emerging topics such as algorithmic and stateless citizenship, while Lauricella et al. [10] concentrated on cultivating these competencies among younger learners.

In light of this, this paper intends to explore the issue of civic awareness education for university students in the internet era.

THE CHARACTERISTICS OF THE INTERNET AND ITS IMPACT ON CIVIC AWARENESS EDUCATION FOR COLLEGE STUDENTS

A Rich and Diverse Open Internet Environment

The internet has brought tremendous changes to society, providing great convenience for our work and daily lives. Additionally, in traditional media, the expression of opinions is constrained by factors such as time, location, space, and gatekeepers. The internet, as an open network environment, creates a public platform for individuals to freely express their opinions online. People can also communicate with others online, turning the internet into an open marketplace of ideas.

Virtuality and Interactivity

With the rise of the internet, online communities and networks have emerged, forming a new kind of cyberspace. Internet users can hide their true selves and present themselves with entirely new identities online. At the same time, the internet rapidly connects nations and regions, forming a virtual internet world. In this virtual space, people can break the limitations of time and space, thereby expanding communication and practice. However, the virtual and anonymous nature of the internet has led to the spread of false information and frequent occurrences of infringements on rights such as reputation, privacy, and image. Many college students bring grievances from their real lives onto the internet, recklessly attacking and insulting others, demonstrating a lack of basic civic qualities[11].

Herd Mentality and Irrationality

The internet transcends the limitations of time and space, shortens the spatial distance between individuals, and accelerates the formation of public opinion, thus exhibiting direct superiority. In the 1970s, German sociologist Elisabeth NoelleNeumann proposed the "spiral of silence" theory, which suggests that people often observe others' opinions before expressing their own to avoid being isolated. When certain views are considered the "majority" or "dominant," people tend to express their opinions actively and courageously. Conversely, under external pressure, people often choose "silence" or conformity[12].

Expansion of Propaganda Channels

The internet provides universities with a new method for educating students in civic qualities. Online courses, webinars, and social media are the main avenues for cultivating civic qualities among college students. Employing various means of news reporting can broaden the audience and improve their cognitive abilities.

Enhanced Participation and Interaction

The interactive nature of the internet enables college students to more actively cultivate civic awareness. They can use this platform to express their views and opinions, as well as engage in discussions and exchanges with others, thereby strengthening their civic awareness. This participation and interaction are highly beneficial for fostering college students' sense of social responsibility and civic awareness[13].

Broadened Global Perspectives

The global and open nature of the internet makes it easy for students to learn about the cultures, histories, and social phenomena of different countries and regions. This global perspective helps students become more competitive and adaptable in their future lives.

THE MODEL OF CULTIVATING DIGITAL CITIZENSHIP IN UNIVERSITIES THROUGH THE INTEGRATION OF ARTIFICIAL INTELLIGENCE AND DATA ANALYSIS

Promoting the Transformation of University Education Models

By integrating artificial intelligence and big data, constructing a "digital citizen" education model can promote the innovation and development of university education models, achieving personalization, intelligence, and efficiency in education[14].

Improving Students' Digital Literacy

Through the development of students' digital skills, network literacy, and awareness of information security, they can better adapt to the needs of the digital age and become creative and capable "digital citizens."

Promoting Interdisciplinary Integration

By introducing artificial intelligence and data analysis technologies into fields such as computer science, data science, and humanities and social sciences, the development of emerging disciplines can be facilitated. Universities, as important bases for talent cultivation, produce "digital citizens" who directly serve economic and social development. Graduates with high digital literacy and creativity will become indispensable members of the workforce and make due contributions to the sustainable development of China's economy and society[15].

Enhancing the Competitiveness of Universities

The "digital citizen" cultivation model, which combines artificial intelligence and big data, can enhance universities' competitiveness in talent cultivation, scientific research, and social services, attracting more outstanding talents and research resources.

THE SYSTEM FOR CULTIVATING DIGITAL CITIZENSHIP IN UNIVERSITIES THROUGH THE INTEGRATION OF ARTIFICIAL INTELLIGENCE AND DATA ANALYSIS

Personal Learning Platform

The intelligent learning resource recommendation system uses artificial intelligence technologies to recommend online courses, ebooks, academic papers, and other teaching resources based on students' learning habits, interests, and progress, and provides personalized customization. Adaptive learning route planning evaluates students' knowledge mastery by analyzing their learning materials and formulates the most appropriate learning routes for them, ensuring the effectiveness and specificity of their learning[16].

Data Analysis and Feedback

The learning behavior analysis system collects students' learning behaviors in realtime, including learning time, progress, and interactions, and analyzes them, enabling students to gain a clear understanding of their learning status and identify areas for improvement. Precise feedback and guidance: Based on data analysis, the system provides students with learning suggestions, error analysis, and knowledge reinforcement feedback and guidance, helping them adjust their learning strategies in a timely manner to improve their learning efficiency[17].

Development of Digital Skills

The ability to process and analyze data: The system is equipped with data processing and analysis tools such as Excel and Python and trains students to analyze and process data through practical cases and case studies. It enables students to proficiently apply these tools to realworld problems. In the process of cultivating "digital citizens," the information security and privacy protection framework focuses on training students in information security and privacy protection. Through related courses and simulated exercises, students understand the importance of information security and master some basic defensive techniques.

Cultivating Students' Sense of Responsibility

Digital ethics and morality: Through case analysis and discussion exchanges, students deeply explore ethical and moral issues in the digital society, such as privacy protection, cyberbullying, and information falsification, thereby enhancing their awareness of ethical and moral responsibilities in the digital society. The social participation and contribution module encourages students to apply their knowledge and skills to society, such as volunteering and digital literacy education, enabling them to contribute to society in their way and enhancing their sense of social responsibility[18].

System Optimization and Iteration

The user feedback module continuously improves the system's functions based on feedback from students, teachers, and other users. The technological innovation and advancement module closely monitors the latest developments in fields such as artificial intelligence and big data analysis, updating and refining the system's technical architecture and functional modules in a timely manner to ensure its advancement and practicality.

KEY TECHNOLOGIES AND APPLICATIONS

Artificial Intelligence (AI)

Intelligent recommendation technology is based on machine learning algorithms, analyzing students' learning behaviors and interests to recommend corresponding learning resources and courses, as well as to plan personalized learning paths. Virtual teaching assistant technology utilizes natural language processing, speech recognition, and other technologies to build virtual teaching assistant systems, providing students with realtime Q&A, guidance, and feedback. Intelligent evaluation applies artificial intelligence technology to improve the grading of students' assignments, exam scoring, and performance assessment, thereby enhancing the accuracy and efficiency of evaluations.

Data Analysis Technology

Learning behavior analysis primarily collects and analyzes data on students' learning behaviors, such as learning time, progress, and effectiveness, providing teachers with references and guidance for education. Teaching effectiveness evaluation refers to the indepth analysis of educational data to assess the effectiveness of educational methods and strategies, thereby providing data support for improving the quality of education. Trend prediction links past data with current trends to estimate students' academic performance and future development potential, laying the foundation for future career planning and individualized training.

Through the analysis of collected learning behavior data, student learning patterns and key behavioral characteristics can be identified. The analysis of this data provides strong support for optimizing teaching strategies and implementing personalized education. Below are several key conclusions and their specific applications derived from data analysis:

From Table 1, an analysis of students' regular learning hours, login frequency, and exam scores reveals the following patterns:

Table 1. Student data

Student ID	Learning Hours (Per Week)	Exam Scores	Weekly Login Frequency	Performance Group
Student_1	4.37	44.14	2	Struggler
Student_2	9.56	94.07	1	High Achiever
Student_3	7.59	76.34	15	Average
Student_4	6.39	53.94	1	Struggler
Student_5	2.4	22.94	5	Struggler
Student_6	2.4	25.83	16	Struggler
Student_7	1.52	22.62	19	Struggler
Student_8	8.8	85.36	4	High Achiever
Student_9	6.41	60.06	3	Average
Student_10	7.37	71.22	17	Average

From the data in Table 1, it can be observed that weekly learning hours are clearly correlated with exam scores. It is evident that students who study for more than 7 hours per week achieve an average score of 85, which is relatively excellent. Students who study for less than 5 hours per week generally score an average of 60.

To better illustrate this, using the K-means clustering algorithm, students are divided into three groups: High Achiever, Average, and Struggler, as shown in Figure 1.

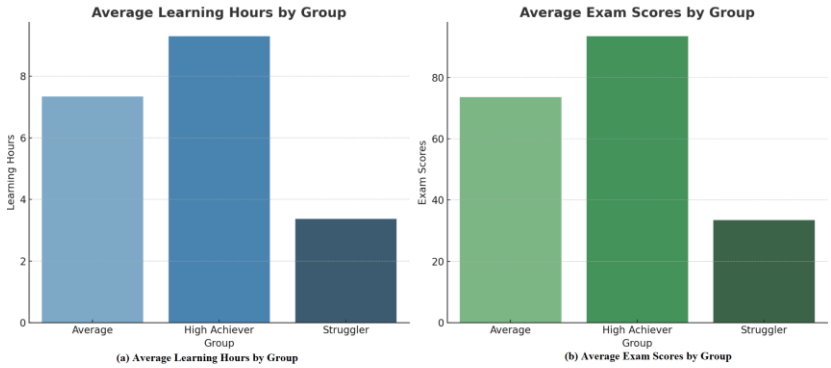

Figure 1. Average learning hours and exam scores of each group

The High Achiever group has an average weekly learning time of 9.56 hours, with exam scores significantly higher than those of other groups, reaching 94.07 points. The Struggler group shows lower learning time and exam scores, with an average learning time of 4.37 hours and exam scores of only 44.14 points.

SYSTEM ARCHITECTURE FOR CULTIVATING DIGITAL CITIZENSHIP IN UNIVERSITIES THROUGH THE INTEGRATION OF ARTIFICIAL INTELLIGENCE AND DATA ANALYSIS

The goal of this course is to train students to become modern individuals with digital literacy who can apply artificial intelligence technologies to solve various complex problems. Below is a system architecture designed based on this objective:

System Objectives

The purpose of digital literacy education is to equip students with certain digital skills, as well as knowledge of information security and personal data protection. This course aims to train students in skills for processing data by comprehensively applying tools such as statistics, pattern recognition, and machine learning. Its goal is to enable students to understand and apply artificial intelligence technologies to practical operations in various fields.

Creative thinking refers to inspiring students to use existing theories and methods to create and solve realworld problems. Artificial intelligence technologies include machine learning, deep learning, and other related fields. Big data processing technologies enhance the efficiency and accuracy of data processing through the storage, processing, and analysis of massive data. Cloud computing provides scalable computing resources and storage services to clients, resulting in higher work efficiency and scalability.

System Architecture

The system architecture diagram is shown in Figure 2.

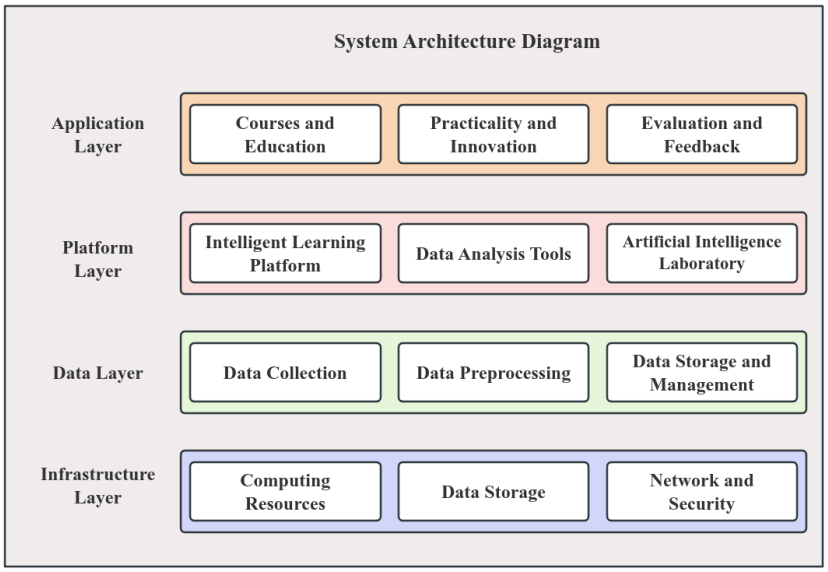

Figure 2. System architecture diagram

Infrastructure layer

(1) Computing Resources: Provide highperformance computing clusters and cloud computing platforms to support big data processing and artificial intelligence model training.

(2) Data Storage: Build distributed databases and data warehouses to store student information, course data, teaching resources, etc.

(3) Network and Security: Establish a secure and reliable campus network to ensure the security of data transmission and storage.

Data layer

(1) Data Collection Layer: Utilize sensors, campus smart cards, and online learning platforms to collect learning behavior data, learning materials, and other data.

(2) Data Preprocessing Layer: Perform data cleaning, transformation, and integration to improve data quality.

(3) Data Storage and Management: Store and manage the processed data and provide interfaces for data access.

Platform layer

(1) Intelligent Learning Platform: Integrate functions such as online learning, course management, assignment submission, and grading to support personalized learning path planning.

(2) Data Analysis Tools: Provide statistical software, data mining tools, and machine learning platforms for teachers and students to conduct data analysis and modeling.

(3) Artificial Intelligence Laboratory: Build a professional AI laboratory equipped with highperformance computers, sensors, and other equipment to support students in conducting AI research projects.

Application layer

(1) Courses and Education: Develop a curriculum system focusing on digital literacy, data analysis, and artificial intelligence.

(2) Practicality and Innovation: Encourage students to participate in various practical activities such as research projects, competitions, and internships, applying their theoretical knowledge to solve realworld problems.

(3) Evaluation and Feedback: Provide students with realtime feedback and individualized guidance through learning outcome displays, topic defenses, and skill assessments.

Support layer

(1) Faculty: Strengthen faculty resources by introducing teachers with strong practical experience and research capabilities to improve education quality.

(2) Policy System: Establish corresponding policies to ensure the stable operation of the system and continuous improvement.

(3) Cooperation and Exchange: Establish close collaborations with domestic and international universities and enterprises to conduct academic exchanges, research collaborations, and talent cultivation.

Implementation Procedures

Comprehensively understand the needs and characteristics of the school to develop targeted planning and execution plans.

At the infrastructure level, enhance support for computing resources, data storage, and network security.

At the platform construction and integration level, conduct research on the development and integration of core platforms such as intelligent learning platforms and data analysis tools.

At the curriculum system construction level, establish a curriculum system centered on digital literacy, data analysis, and artificial intelligence, and provide corresponding teaching materials and resources.

At the faculty training and qualification certification level, improve teachers' professional competencies through faculty training and qualification certification.

At the promotion and application level, promote the application of artificial intelligence technologies across the entire system and encourage students to actively participate in various practical activities and innovation projects.

At the evaluation and feedback level, establish a comprehensive evaluation system and continuously improve and refine the system based on feedback from teachers and students.

Application Measures

First, offering courses on artificial intelligence and data analysis: Universities should offer courses on cuttingedge technologies such as the basics of artificial intelligence, machine learning, and big data analysis, enabling students to acquire foundational theoretical knowledge and practical skills. Multidisciplinary integrationshould be promoted, integrating artificial intelligence with various disciplines such as medicine, law, and art to form interdisciplinary and comprehensive digital citizens. Digital literacy education, focusing on topics like network security, data ethics, and information filtering, should be conducted to enhance students' network literacy and digital moral quality.

Second, building practical teaching platforms: Develop intelligent learning management platforms by leveraging artificial intelligence technologies to integrate online and offline teaching resources and recommend personalized learning paths. Virtual reality (VR)/augmented reality (AR) technology applicationsshould be utilized to create virtual simulation educational scenarios, allowing students to engage in immersive practical operations and experiments to improve learning efficiency and practical skills. Schoolenterprise cooperation projectsshould be carried out to engage students in real enterprise projects, enabling them to apply their knowledge to solve realworld problems, fostering innovative thinking and teamwork skills.

Third, faculty development: Strengthen the training of existing teachers to enhance their teaching capabilities in artificial intelligence and data analysis. Actively recruit highlevel talent with rich industry experience and significant research achievements to enrich the teaching staff. Establish interdisciplinary teaching teams, encouraging collaboration and communication among teachers to jointly develop innovative and practical teaching resources and cases.

Fourth, establishing an evaluation indicator system: Employ a variety of evaluation methods, including formative, summative, and peer evaluations, to comprehensively assess students' academic performance and overall qualities. This project proposes using big data analysis methods to deeply mine and analyze students' learning data, identify learning patterns and problems, and provide a theoretical basis for personalized education.

Fifth, creating a positive environment and culture: Foster a positive digital culture environment by encouraging students to actively participate in digital innovation activities, competitions, and community services, thereby enhancing their digital literacy and social responsibility. Increase efforts to promote awareness of network security and ethics, shaping students' correct network values and behavioral norms to prevent illegal activities such as online fraud and privacy infringement.

Sixth, international cooperation and exchange: Actively participate in international digital education cooperation programs and collaborate with renowned overseas universities and enterprises on joint training, research, and technological innovation. Provide opportunities for students to study and visit abroad, allowing them to experience the digital education and cultural atmosphere of various countries and regions, broaden their international perspectives, and improve their crosscultural communication skills.

PATHWAYS FOR CONSTRUCTING CIVIC AWARENESS EDUCATION FOR COLLEGE STUDENTS RELYING ON THE ADVANTAGES OF THE INTERNET

The network environment provides new opportunities as well as new challenges for cultivating civic awareness among university students.

Strengthening and Improving Campus Network Construction

Establish professional patriotic education websites. A highquality campus network should integrate ideological, informative, and entertaining elements; it should be serviceoriented, providing comprehensive, highquality services to all students, thereby attracting more students to visit. This makes it a place that students like and care about. To enhance its relevance, a specialized campus network can be set up for promotion. To better connect with students' lives and utilize the sharing nature of the internet, videos or essays on civic awareness education recorded by students themselves can be collected and uploaded. This encourages them to actively participate in cultivating civic awareness. Creating a positive social environment based on freedom and equality, rights and responsibilities, and moral selfdiscipline can also promote the development of students' sense of individuality, political awareness, and a noble sense of morality.

Strengthening the Construction of Internet Talent Teams

Focus on guiding online public opinion. Cultivating civic awareness among university students using the internet as a medium is a brandnew task, requiring administrators to be familiar with professional network technologies and key aspects of civic awareness cultivation. Strengthening the construction of internet talent teams is essential to ensure they can serve as qualified "gatekeepers" on civic awareness education websites for college students. Such talent should be wellversed in the characteristics of the internet, enrich online content, actively integrate beneficial resources, and guide the organization of website information to create a strong positive public opinion. With an objective and fair attitude, they should promote the gradual maturation of college students' civic awareness, strengthen the control of online information, and guide students' healthy growth and development.

Emphasizing Traditional Ideological and Political Theory Courses

Innovations in teaching methods are necessary. Ideological and political theory courses in universities are systematically planned and implemented. In the online world, we cannot afford to be complacent. Teaching methods can leverage the internet to increase classroom interest and efficiency. By providing indepth education to university graduates, their understanding of fundamental concepts can be enhanced. For instance, when teaching courses such as *Outline of Modern Chinese History* and *Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics*, purposefully selecting certain online works or videos that cannot be published or broadcast on traditional media and offering reasonable explanations for their rationality or controversies can engage students. On this basis, students can express their own opinions, which are then evaluated by the teacher.

CONCLUSION

In summary, the measures for cultivating digital citizenship in universities through the integration of artificial intelligence and data analysis need to address multiple aspects, including the curriculum system, practical teaching platforms, faculty development, evaluation systems, environment and culture, as well as international

cooperation and exchange. These efforts aim to comprehensively enhance students' digital literacy and overall capabilities. In the future, it is necessary to continue exploring and improving this model to cultivate more highquality, highly capable digital citizens who can contribute more to the development of society.

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