Large Language Model in Civic Education: Innovations in Higher Education

Shidong Li[1], Li Li[2*], Binting Li[1]

[1] North University of China, Taiyuan, Shanxi, China
[2] JinZhong University, JinZhong, Shanxi, China

*lili0916@jzxy.edu.cn

Abstract. With the rapid development of information technology, large language model (LLM) technology has shown significant potential in higher education civic education. Faced with the challenges of monotonous forms and the impact of internet values, civic education needs to enhance the pertinence of content and the interactivity of the process through innovation and reform. This paper analyzes the characteristics and advantages of LLM in university civic education, the problems and strategies faced by university civic education under the background of big data and large models, and outlines the application scenarios of LLM in four aspects: innovation in teaching content form, breakthroughs in teaching methods, assistance in teaching process, and innovation in teaching practice. Finally, the paper points out the challenges of the artificial intelligence era and proposes strategies to deal with them, emphasizing the importance of improving the effectiveness and quality of civic education. This study provides new ideas and references for the reform and innovation of university civic education and has reference significance for promoting the theoretical and practical innovation of university civic education.

Keywords: Large Language Models, University Civic Education, Scenario Innovation, Application Innovation.

1 Introduction

University civic education focuses on students' ideological and moral qualities, political awareness, and social responsibility, aiming to shape students with firm ideals and comprehensive qualities. However, with social changes and the evolution of youth thought, civic education faces new challenges.

Currently, university civic education faces multiple challenges. First, the impact of online information requires students to have stronger discernment, and guiding them to establish correct values has become a core task. Second, traditional teaching models struggle to meet students' personalized learning needs, and the innovation and practicality of teaching content urgently need to be strengthened. Teachers' adaptability to new technologies, especially the potential of cutting-edge technologies such as LLM, has not been fully exploited. The deep integration of civic education with information

D. Hu et al. (eds.), *Proceedings of the 2024 5th International Conference on Modern Education and Information Management (ICMEIM 2024)*, Atlantis Highlights in Social Sciences, Education and Humanities 29,
https://doi.org/10.2991/978-94-6463-568-3_47

technology is still in its infancy, limiting the innovation and development of educational models.

Artificial intelligence, as an important productive force for future educational content generation, can provide innovative support for university civic education. It can enrich educational resources, match students' needs on a personalized basis, and provide a variety of teaching content. At the same time, through prompt engineering and RAG technology, LLM can enhance the pertinence and timeliness of civic education, help cope with the challenges brought by social changes, and cultivate an excellent younger generation with a sense of social responsibility and national sentiment.

2 Characteristics and Advantages of LLM in University Civic Education

Large Language Models (hereinafter referred to as LLM) are AI models that have been trained on vast amounts of text data. Utilizing large pre-trained models and given all previous input text, they can predict the next word and generate coherent, human-like responses to queries by using massive amounts of training data, ultimately automatically creating various forms of content such as articles, videos, images, music, and code. The core principle is that through machine learning and deep learning techniques, the model is first trained on a large-scale dataset to learn the implicit features and patterns in the data, and then it can automatically generate new content based on user input or specific prompts.

Although the exact amount of training data is not publicly known, GPT-3's 175 billion parameters demonstrate the complexity and sophistication of the model [1], [2]. These models can generate human-like text, answer complex questions, write articles, respond to queries, and assist in language translation with remarkable accuracy [3]. ChatGPT4 has been proven to pass the United States Medical Licensing Examination, the Bar Exam, the Scholastic Assessment Test (SAT) in reading and writing, the Graduate Record Examination (GRE), and parts of the Master of Business Administration (MBA), often achieving high scores. Open AI released the o1 series of large models on September 13, 2024, at midnight, which is OpenAI's first large model with complex reasoning capabilities. The new model o1 excels at general complex reasoning and performs exceptionally well in fields such as physics and informatics. OpenAI CEO Ultraman said it marks the beginning of a new paradigm: artificial intelligence capable of general complex reasoning. This ability to generate meaningful text has attracted considerable attention in the field of education due to its potential to transform teaching methods and enhance students' learning capabilities [4],[2].

Unlike traditional technologies, LLM can quickly generate content, saving labor costs, while traditional technologies often rely on manual creation and are less efficient. LLM can also generate customized content based on user needs and preferences, improving user experience, which traditional technologies find difficult to achieve with high personalization. In addition, LLM can generate various forms of content (text, images, audio, etc.), while traditional technologies are usually limited to creation in a single field. Furthermore, it can continuously improve the quality of generated content

through continuous training and updates, while traditional technologies often require a longer time and cost for modifications and upgrades. It can also reconstruct the identity of the subject in a "dialogue-like" manner, generating content from different perspectives and styles for the educated, breaking through the limitations of traditional technologies that are constrained by the experience and vision of the author. Overall, LLM has the advantages of being efficient, flexible, diverse, and innovative in content generation, and has the potential to revolutionize the creative methods in many fields.

LLM can flexibly respond to the needs of various application scenarios. In addition to content generation, it can also achieve content categorization and analysis. Moreover, through interface calls, LLM also has advanced functions of human-computer collaboration, capable of providing personalized customized services based on user behavior patterns and preferences, thereby achieving the full process generation from instruction to implementation.

The development of LLM technology provides support for the innovative development of civic education from the perspective of artificial intelligence. Smart civic education based on LLM is the result of the integration of civic education courses with LLM, informatization, and digital technology, aiming to achieve educational innovation in civic education content, forms, plans, and interactive rehearsal through large language models and specific prompt engineering. This enables civic education to adapt to the development of the times and guide students' thoughts, morals, and value orientations.

As shown in Table 1, it presents the application of LLM in civic education in various aspects. In terms of personalised learning, Carnegie Mellon University has led it through its Teaching & Learning Open Learning Initiative. For automated grading, Carnegie Mellon University uses LLMs for immediate feedback. University of Illinois Urbana - Champaign utilises LLMs for literature review and data analysis in research. Tools like Mendeley use LLMs for drafting and editing. Georgia Institute of Technology introduced an LLM teaching assistant. Stanford University uses chatbots for administrative support. Massachusetts Institute of Technology uses LLMs for curriculum analysis and improvement. LinkedIn Learning and Coursera offer AI - driven courses for professional development. Harvard University and others leverage LLM for library services. Arizona State University uses LLMs for interactive learning environments. Southern New Hampshire University pioneers using LLMs for enhancing online education.

Table 1. Application of LLM in civic education.

Area	Application	Example
Personalised Learning	Open Learning Initiative	Carnegie Mellon University has led personalised learning through its Teaching & Learning Open Learning Initiative[5].
Automated Grading	Immediate Feedback	Carnegie Mellon University uses LLMs to provide immediate feedback to students[5].
Literature Review	Research Assistance	University of Illinois Urbana-Champaign utilises LLMs in research, aiding in faster literature reviews [6].

Data Analysis	Research Support	The University of Illinois Urbana-Champaign utilises LLMs for data analysis in research, aiding in faster data interpretation [6].
Drafting and Editing	Academic Writing Tools	Tools like Mendeley (widely adopted across universities) use LLMs to assist in drafting and editing [8]
Assistive Technologies	Online Teaching Assistant	Georgia Institute of Technology introduced LLMs teaching assistant, "Jill Watson", on their online platforms [7].
Chatbots for Student Services	Administrative Support	Stanford University has started using chatbots to provide 24/7 student services, answering FAQs about admissions, campus life, etc. [9].
Curriculum Analysis and Improvement	Curriculum Development	Massachusetts Institute of Technology uses LLMs to analyse and improve curriculum, ensuring courses meet evolving student and industry needs [10].
Professional Development and Training	Faculty Development	LinkedIn Learning and Coursera, partnered with various universities, offer AI-driven courses for professional development, using LLMs to personalise learning paths[11].
Information Retrieval and Research Assistance	Library Services	Harvard University and several other institutions leverage LLM technology to enhance library services, including advanced information retrieval and providing comprehensive research assistance [12].
Interactive Learning Environments	Student Engagement	Arizona State University uses LLMs in its digital learning platforms to create more interactive and engaging learning environments [13].
Enhancing Online Education	Distance Learning	Southern New Hampshire University pioneers using LLMs to enhance the online education experience, from personalised learning to administrative support [14].

3 Issues and Solutions in University Civic Education under the LLM Framework

Analyzing the existing problems in civic education from both teaching and learning perspectives, the current issues in university civic education mainly include the following aspects:

From the teaching process, the teaching philosophy and methods are outdated. Although teachers possess extensive theoretical knowledge, the entire class is often dominated by the teacher's monologue at the podium, with students passively receiving information. This one-dimensional teaching model makes the classroom atmosphere dull and results in low student engagement.

In terms of teaching content, there is a lack of significant achievements made by our country in recent years, making it difficult for students to resonate. This leads to a lack of appeal and a sense of timeliness in university civic education. There is also a disconnect between civic education and professional education, with some teachers struggling to effectively integrate civic education content with professional courses. As a result,

the content of civic education appears isolated, lacking connections between knowledge, and failing to inspire students to construct a comprehensive thinking system.

From the learning process, the content of university civic education is not closely linked to students' real-life experiences and future career development, leading to a lack of interest in civic education courses and insufficient recognition of their importance.

"The integration of LLM and civic education courses is an indispensable strategic link in comprehensively advancing the modernization of higher education"[15]. To address these issues, combining LLM technology can bring a series of innovations and improvements to university civic education. First, through AI algorithms, personalized lesson plans can be automatically generated based on students' learning backgrounds and needs, ensuring the pertinence and effectiveness of the teaching content. This aligns with the requirements of educational technology integration theory, which posits that LLM technology should be used as a teaching tool, integrated into civic education to improve teaching efficiency and student learning experiences. "Innovative teaching in higher education is characterized by a departure from traditional lecture-based pedagogy towards student-centered, active learning approaches." [16] Personalized teaching not only better captures students' attention but also brings teaching closer to their actual needs. This indicates that by using LLM, we can provide students with more personalized and immersive learning experiences, which is in line with the innovative teaching methods advocated by Skenderi and Skenderi.

Secondly, AI systems can monitor students' learning progress and responses in real-time, dynamically adjusting the teaching content and difficulty based on the collected data to suit different students' learning paces. The real-time learning feedback mechanism not only enhances the flexibility of teaching but also boosts students' motivation. The educational technology integration theory emphasizes the auxiliary role of technology in education; through real-time feedback, teachers can better understand students' learning conditions and adjust teaching strategies in a timely manner to ensure that every student can keep up with the course progress. "This study explores the innovative fusion of AI with teaching methodologies, aiming to enhance educational outcomes and foster comprehensive student development."[17]

Student-centered learning theory posits that education should be centered on students' needs and interests, designing personalized teaching content and activities to promote active learning and deep engagement. Therefore, designing interactive segments can effectively enhance student participation and stimulate their interest in learning. Based on LLM, a variety of interactive segments can be designed, such as group cooperation and situational simulations, to promote active learning and communication among students and improve teamwork skills. This not only meets the requirements of student-centered learning theory but also reflects the philosophy of multiple intelligences theory, which recognizes the diversity of students' intelligences and satisfies the needs of different learning styles through diverse teaching methods, enhancing the inclusiveness and effectiveness of teaching.

Constructivist learning theory advocates that learning is an active construction process, where students should construct knowledge through practice and form their own

understanding and insights. Interdisciplinary knowledge integration is a concrete application of constructivist learning theory; by combining civic education with other subjects, students' comprehensive application abilities can be enhanced, allowing them to apply their knowledge in real-life situations. LLM's understanding and classification capabilities help identify connections between civic education and other subjects, integrating relevant content into lesson plans and promoting students' comprehensive application abilities.

In terms of implementation strategies, first, it is necessary to strengthen LLM technology training for university teachers to enhance their technical application skills in civic education. The educational technology integration theory points out that teachers are the key to technology application; only when teachers master the relevant skills can they better leverage the role of technology. Second, establish a comprehensive teaching effectiveness evaluation system, collect student feedback in a timely manner, and continuously optimize teaching strategies to ensure the quality and effectiveness of civic education.

4 Application Scenarios of LLM Integration with University Civic Education

The application of LLM in university civic education encompasses various aspects such as text analysis, multimodal generation, summarization, content categorization, and dialogue Q&A. The integration of these technologies has brought unprecedented changes to civic education classrooms.

In terms of functional application, text analysis and summarization technologies can efficiently distill key teaching points; multimodal generation technologies enrich teaching resources through animations, videos, and significantly enhance teaching efficiency and methods; content categorization technologies achieve precise matching of teaching resources; and dialogue Q&A technologies improve student engagement and learning experience by simulating real conversations, making civic education more vivid and better adapted to modern educational needs.

In terms of specific scenario applications, LLM-generated content can realize innovation in teaching content and form; in teaching methods, the combination of LLM technology with Problem-Based Learning (PBL) models provides students with more personalized and interactive learning experiences; LLM technology empowers teaching processes, from lesson preparation, question-answer rehearsal to grade analysis, providing intelligent assistance tools for teachers, making teaching management more efficient; in terms of teaching practice innovation, LLM generation technologies create a richer and more flexible learning environment for students by providing virtual laboratories, interactive storytelling, and multilingual learning platforms.

4.1 Content Innovation: The Intelligent Transformation of Teaching Content Forms

In the field of university civic education, the introduction of LLM technology can promote innovation in teaching content forms. Its core advantage lies in its ability to transform traditional text materials into multimedia forms that include images, videos, and audio, greatly enriching the content and presentation methods of teaching.

Content Innovation.

In the context of the new era, innovation in civic education is crucial. The integration of LLM technology provides infinite possibilities for the innovation of civic education content. "It leverages technology to facilitate personalized and immersive learning experiences, breaking down geographical barriers and fostering global collaborations." [16]. How to use LLM technology to enrich and deepen the content of civic education to enhance the effectiveness and appeal of education has become a hot topic of research.

The application of LLM technology in the innovation of civic education content is first reflected in the concretization of abstract theories. Through interactive story development, LLM technology creates interactive stories that integrate civic education theories into the plot, allowing students to naturally absorb and understand theoretical knowledge while exploring the story. In addition, LLM-assisted case study analysis tools deeply mine classic cases in civic education, providing multi-dimensional interpretations to help students distill the essence of theories from cases. Personalized content recommendations use LLM algorithms to analyze students' learning behaviors and interest preferences, pushing personalized civic education content such as relevant books, articles, videos, etc., enhancing the pertinence and interest of learning. LLM technology not only concretizes abstract theories but also significantly enhances the sensory experience of civic education. Multi-sensory integrated teaching materials combine LLM and VR technologies to develop multi-sensory integrated teaching materials, allowing students to experience civic education content in a virtual environment, such as simulating historical scenes and experiencing legal practices. Emotional resonance guided by LLM uses LLM technology to monitor students' emotional responses, adjusting teaching content and pace to guide students to produce emotional resonance, deepening their understanding and recognition of civic education theories.

In terms of teaching micro-courses and video content production, the application of LLM technology has brought new vitality to civic education. Intelligent micro-course video generation uses LLM technology to automatically generate micro-course videos, combining the latest social cases and theoretical developments, making civic education content more in line with the pulse of the times. Intelligent Q&A and analysis system development of LLM intelligent Q&A systems, targeting the difficulties and hot issues in civic education, provides students with immediate answers and in-depth theoretical analysis. LLM-enabled civic education content innovation not only enriches teaching resources but also enhances the appeal and effectiveness of education. By concretizing theories, enhancing sensory experiences, and intelligent micro-course videos, civic education will better serve the comprehensive development of students.

Form Innovation.

With the continuous development of LLM technology, the form of civic education has new developments, and teachers and students can innovate teaching models to achieve more efficient interaction.

The application of LLM technology in the innovation of civic education forms can start from two aspects: virtual tutors and thought experiment platforms. Virtual tutor systems create LLM virtual tutors, simulating political figures, historical figures, or moral models, engaging in virtual dialogues with students, providing personalized learning guidance and suggestions. Thought experiment platforms develop LLM-based thought experiment platforms, allowing students to explore different social phenomena and moral dilemmas in a virtual environment, cultivating critical thinking and innovation abilities. LLM technology provides new ways to create immersive learning experiences. Historical time-travel experience uses LLM and VR technologies to create historical time-travel experiences, allowing students to "personally" experience significant historical events, enhancing the immersion and experiential nature of learning. Emotional interaction teaching modules design LLM emotional interaction teaching modules, providing emotional support and guidance by recognizing students' emotional states, enhancing the emotional resonance of civic education.

In terms of teaching resource push and customization, the application of LLM technology has brought new changes to civic education. LLM anchor tells civic education stories, creating LLM anchors to tell civic education stories in video or audio form, improving the interest and dissemination efficiency of the content. Personalized micro-course video recommendations achieve intelligent recommendation and personalized customization of micro-course videos, automatically pushing relevant teaching videos according to students' learning progress and preferences, improving the personalization and effectiveness of learning. LLM-driven civic education form innovation breaks traditional teaching paradigms, injecting new vitality into civic education. Through virtual tutors, immersive experiences, and intelligent resource push, civic education will better meet the learning needs and cognitive characteristics of modern students, achieving the maximization of educational effects.

LLM technology enhances the attractiveness and understandability of information. By combining visual and auditory elements, LLM-generated teaching materials can stimulate students' sensory experiences, thereby improving the attractiveness and memorability of learning materials. This multi-sensory learning method has been proven to improve learning efficiency and depth. "The teaching experiment demonstrates that integrating AI ethics with ideological and political education is more effective." [18]."

4.2 Method Innovation: LLM-Driven PBL Teaching Method

PBL is a method that allows students to understand problems fundamentally through designed questions. As a mature teaching method, it stimulates students' interest and initiative through problem-driven approaches, which is particularly suitable for cultivating students' critical thinking and practical problem-solving abilities. In the field of civic education, PBL methods can allow students to deeply understand the starting and

ending points of various civic education knowledge points, thereby establishing a comprehensive and independent thinking system, and calmly facing the impact of external ideological trends.

Combining the multi-round dialogue capabilities of LLM technology with PBL teaching methods provides an innovative teaching model for university civic education. LLM technology simulates a real discussion environment, providing continuous and purposeful feedback based on students' questions, thereby promoting students' active learning and problem-solving abilities. At the same time, LLM technology can also automatically generate data analysis and result presentation, helping students better understand and master knowledge. Personalized learning experiences ensure that each student receives guidance that matches their cognitive level and interests, and as an intelligent classroom assistant, LLM enhances the interactivity between teachers and students through voice interaction.

In addition, LLM supports the cultivation of deep learning and critical thinking, helping students to fully understand problems and form their own opinions. Therefore, combining LLM technology with PBL theory to innovate civic education teaching models is not only technically feasible but also theoretically applicable, making teaching more in line with students' actual needs.

The following are four scenarios showing how LLM technology can empower PBL teaching methods to enhance civic education.

Project Initiation Phase. LLM technology generates engaging project introduction videos or graphic materials to stimulate students' interest and participation enthusiasm. For example, by inputting students' learning situation information and course knowledge points, as well as the expected teaching goals, teachers can create interactive multimedia materials related to the course theme through LLM, allowing students to immediately engage and generate interest at the beginning of the project. The interactive nature of LLM's dialogue system can also be effectively utilized, allowing students to interact with LLM, ask questions, and receive immediate answers, which helps deepen students' understanding of the project theme and lays a solid foundation for subsequent learning and inquiry activities.

Needs Analysis Phase. During the PBL needs analysis phase, LLM's text analysis function can help students quickly sort out relevant materials and extract key information. LLM technology can not only process a large amount of literature and data to provide students with refined information summaries, thus saving time and improving efficiency. "Artificial intelligence technology has prompted the ideological and political education of college students to change from traditional experience-driven to data-driven, let it change from teacher-student co-construction to human-machine co-construction... [18]." " LLM technology can provide data visualization tools to transform complex data and information into charts and graphics, helping students better understand the project background and requirements, providing a clear direction for subsequent project goal setting and team building.

Goal Setting and Team Formation. LLM technology can extract students' content and interest points from their discussion records, automatically generate suggestions for project goals and outcome indicators, help students clarify their learning direction, and set achievable goals. At the same time, it can provide an analysis of students' abilities and personalities, offering team formation suggestions to ensure the diversity and complementarity of team members. In team collaboration, with the help of LLM's member status analysis and academic management, team members can communicate and collaborate more effectively, thereby improving the efficiency of team cooperation.

Inquiry and Execution, Supervision and Feedback. In the PBL inquiry and execution phase, LLM technology can generate multimodal learning resources such as videos and charts to support students' inquiry activities. LLM's dialogue system can simulate expert consultation, providing professional guidance for students, helping them solve problems encountered during project implementation. "The assessment of student learning in innovative settings requires reevaluation and redesign of traditional evaluation methods."[16] For example, in the supervision and feedback phase, LLM technology can provide feedback for teachers based on project progress descriptions, helping teachers adjust teaching strategies in a timely manner,

4.3 Process Optimization: LLM-Assisted Teaching Process

The implementation of civic education classes mainly involves three stages: pre-class preparation, in-class implementation, and post-class reflection. The application of LLM in these three stages demonstrates three characteristics: personalized customization, real-time interaction, and data-driven decision-making.

During the lesson preparation phase, teachers first input the teaching objectives, followed by the knowledge points and their interconnections, as well as supporting cases. LLM technology assists teachers in analyzing textbook content, generating syllabuses and courseware, which teachers can then further correct and refine, achieving iterative improvement of the lesson plan. By leveraging LLM's text analysis and natural language processing capabilities, teachers can quickly extract key and difficult points for teaching and construct a course framework.

In the classroom interaction segment, many students do not actively participate in classroom interactions and do not have a deep understanding of the issues and cases discussed. During the early stages of lesson plan design, teachers can use LLM to analyze the connections between cases and knowledge points, as well as potential points for questioning, and then rehearse Q&A sessions to help optimize question design. In the classroom, based on students' responses and engagement, LLM can further break down or deepen the original questions, posing more targeted queries to promote student thinking and participation. This enables teachers to better guide classroom discussions and enhance the interactivity of teaching. Teachers can more accurately grasp students' learning states and adjust teaching strategies in a timely manner, achieving personalized teaching.

Grades are a reflection of examination results and an evaluation metric for student learning. Traditionally, integrating students' performance in civic education classes and their behavior outside the classroom requires a significant amount of manual data collection and processing. Utilizing LLM technology can conveniently recognize audio, video, and image content, as well as the performance of individuals. By inputting students' assignments, tests, grades, and classroom records, content can be rapidly digitized, and data analysis can be accurately conducted to provide feedback on students' learning outcomes. Furthermore, LLM can perform a correlation analysis among the teaching process, results, and student states, identifying learning patterns and potential issues among students. This helps teachers adjust teaching strategies in a timely manner, implement personalized teaching, and evaluate students' learning effects more objectively, providing students with more precise guidance and assistance.

4.4 Practical Assistance: Application of LLM in Teaching Practice

Teaching practice involves students effectively applying what they have learned in real-life production and daily life. Civic education places greater emphasis on the soundness of thinking and the sublimation of consciousness. In the practice of civic education at universities, LLM technology can enhance teaching effectiveness and student engagement by assisting with educational resources and participation.

Matching of Practical Teaching Resources with Objectives: Generate practical teaching resources that align with teaching objectives, supporting students in applying the PDCA cycle in practice. Students can set practical goals, seek relevant resources, design and implement practical plans, and finally reflect and summarize the outcomes. LLM technology generates personalized practical tasks, ensuring that students' learning activities are closely integrated with actual needs.

Literature Search and Scientific Research: Assist students in the scientific research process with literature searches and review writing, helping them clarify research directions and generate preliminary plans. The literature and data generated by LLM technology can be used as a basis for plan design, ensuring the scientific and innovative nature of the research.

Experimental Simulation: Generate simulated scenario videos from textual descriptions, showcasing the plans designed by students. These demonstrations allow students to more intuitively understand the background of the problem and potential solutions, verify the feasibility of the plan, and optimize it in conjunction with feedback from simulated experiments. At the same time, it supports students in conducting feasibility analysis before implementing practical plans and generating simulated plans under different scenarios. This rehearsal helps reflect on and adjust the plan, improving the quality of practical planning.

Civic Education in Professional Courses: LLM technology analyzes the points of integration between civic education content and professional courses, combining elements of civic education with professional course content. It automatically searches for relevant cases, discussion topics, and practical activities, allowing students to naturally encounter and understand civic education theories in their professional studies, achieving an organic integration of knowledge and values.

5 The Impact of LLM in Civic Education

The application of artificial intelligence (AI) in the realm of civic education has brought about significant effects and profound changes. Firstly, the introduction of AI technology has significantly enhanced teaching effectiveness and student learning outcomes. Tools like Multi-task Classroom Behavior Recognition Networks (MCBRN) can accurately identify student behaviors and provide personalized instructional support, thereby increasing student engagement and learning outcomes. Furthermore, AI-assisted teaching models have demonstrated outstanding performance in improving students' test scores and abilities related to civic education. Students in the experimental group outperformed those in the control group in areas such as innovative thinking, teamwork, communication, and other critical skills. Additionally, the application of AI technology has facilitated the integration of mental health education with civic education, enhancing students' mental health levels and the quality of their civic learning through collaborative educational models.

Secondly, the application of AI technology has introduced diversity and flexibility into educational resources and teaching methods. Interactive and personalized learning experiences have stimulated students' interest and motivation, fostering their active participation and deep learning. Teachers can leverage AI tools to design more effective teaching activities, such as case studies and scenario simulations, thereby enhancing the appeal and practicality of instruction. More importantly, the application of AI in educational assessment and decision-making processes allows teachers and educational administrators to better understand student needs through the analysis of learning data and behavior patterns, leading to scientifically informed and reasonable educational decisions. Overall, the application of AI technology in civic education has brought about comprehensive improvements, driving education towards greater efficiency, precision, and personalization.

In terms of outcomes, LLM have demonstrated significant results in civic education [17]; refer to Table 2 for detailed findings.

Table 2. results of LLM in civic education.

Educational Dimension	Before Application	After Application	Effectiveness
Exam Scores	76.55	92.25	20.51% increase
Innovative Thinking	69.15	88.43	27.88% increase
Team Writing Ability	71.21	87.42	22.76% increase
Communication Skills	61.63	71.99	16.81% increase
Learning Interest	82.64	93.67	13.35% increase
Self-study Ability	68.41	80.15	17.16% increase
Professional Behavior	62.45	73.78	18.14% increase
Problem-solving Ability	64.67	74.04	14.49% increase

6 Challenges and Responses of LLM to Future Civic Education

LLM-generated content provides new ways of content production and dissemination for university civic education, while also posing new challenges in terms of educational methods, subjects, and effectiveness.

Firstly, LLM has a disruptive impact on educational methods, mainly reflected in the shift from knowledge dissemination to knowledge innovation, from uniform teaching to personalized learning, and from closed education to open education. The gradual shift from knowledge dissemination to knowledge innovation requires students not only to master knowledge but also to possess innovative thinking and capabilities. The transition from uniform teaching to personalized learning necessitates that education pays more attention to individual differences among students and meets the learning needs of different students. The shift from closed to open education enriches and diversifies educational resources, but it also brings challenges in information screening and management. These changes provide new ideas and methods for university civic education, but also bring new requirements and challenges. With the development and application of LLM technology, education is no longer limited to the dissemination and inheritance of knowledge, but focuses more on creation and innovation. Its intervention makes education more personalized, flexible, and efficient, achieving precise content matching, adaptive adjustment of processes, and real-time assessment and optimization of outcomes. At the same time, supported by technology, education becomes more equitable, open, and collaborative, promoting resource sharing, inclusive services, and ecological collaboration.

Secondly, LLM poses new requirements for teachers, and university teaching reform faces practical dilemmas such as teacher quality, teaching resources, and teaching models. It is necessary to strengthen teacher training, optimize the allocation of teaching resources, and innovate teaching models. To adapt to the benign cycle of the teaching ecology in the new environment, teachers should focus more on cultivating students' creative thinking abilities, value formation, and improving data literacy and humanistic literacy in teaching. Specifically, teachers need to strengthen their learning and application of LLM technology and be able to skillfully use LLM tools to assist in teaching. At the same time, teachers should pay attention to the emotional and value development of students and guide them to correctly understand and use LLM. In addition, schools should provide corresponding training and support to help teachers enhance their capabilities.

Lastly, LLM poses challenges in terms of ideological security and teaching quality, specifically manifested in the misuse of intelligent teaching scenarios and the risks of data dependency behind the black box of algorithms. To address these risks, it is necessary to identify entry points and integration points based on the teaching objectives and content of civic education courses, and construct a situational classroom oriented by the core values of socialism, making intelligent teaching scenarios serve the key and difficult points of teaching. In practical operations, teachers can strictly screen and review the content generated by LLM to ensure its compliance with teaching objectives and values. At the same time, breaking the algorithmic black box and establishing a traceable and interpretable student assessment system is crucial to prevent over-reliance

on LLM assessments, and teachers must have the ability to make independent judgments on analytical conclusions. Additionally, strengthening students' information literacy education and improving their ability to discern and filter information is essential. Therefore, it is necessary to propose three requirements for the application of LLM in civic education: standardization, sustainability, and scalability. These requirements are crucial to ensure the rational use of LLM technology, maintain educational quality standards, and promote the long-term development of education.

"The great application potential of artificial intelligence (AI) and the accompanying ethical issues have triggered widespread concern in the field of education [18]." Therefore, standardization refers to the need for a set of clear guiding principles and operational specifications when applying LLM to civic education, ensuring that the use of LLM technology aligns with educational objectives and promotes the cultivation of socialist core values. Strict control of LLM-generated content is required to ensure its accuracy and directionality; clear ethical guidelines should be established to prevent misuse of technology and improper behavior. "Educational administrators need to increase the education privacy protection for college students, strengthen the development of AI technology, develop ideological and political education for college students in a balanced way..." [18]."

Sustainability emphasizes the need for a comprehensive and balanced approach in the process of applying LLM technology to improve civic education, ensuring that the quality and effectiveness of education can be maintained and enhanced in the long term. This involves effective allocation of educational resources, including the training of teaching staff and the updating of teaching facilities, as well as continuous optimization of teaching methods to keep pace with technological development and meet the changing needs of students.

Scalability refers to the consideration of future expansion and development potential of the education system when designing and implementing LLM-based civic education programs. This means that the technologies and methods used should be flexible and forward-looking, allowing for adjustments and upgrades as technology advances and educational needs evolve. This scalability requires a focus on cultivating students' comprehensive abilities during the educational process, especially those skills that are indispensable in future society, such as critical thinking, innovation ability, and cross-cultural communication skills.

By focusing on the standardization, sustainability, and scalability of LLM in enhancing the effectiveness and quality of civic education, we can ensure the rational use of this cutting-edge technology and promote the long-term prosperity and development of the educational cause. This requires not only technological innovation and optimization but also corresponding adjustments and improvements in educational concepts and methods to adapt to this rapidly changing era.

7 Conclusion

LLM offers infinite possibilities for civic education. This educational model, which aims at civic education, uses courses as carriers, and innovation as a driving force, is

characterized by its intelligence, creativity, openness, and collaboration. It provides new methods for university civic education, promoting the organic unity of civic education's civic nature, academic nature, practicality, and interest, and enhancing the effectiveness and quality of civic education.

The main contribution and innovation of this paper lie in systematically elaborating the connotation and characteristics of LLM-generated content from both theoretical and practical perspectives, and analyzing its value and application innovation in university civic education. Secondly, it focuses on the challenges brought by LLM-generated content and proposes to address them from the three aspects of standardization, sustainability, and scalability, to ensure the rational use of cutting-edge technology and the long-term prosperity and development of civic education.

Doing a good job in civic education requires not only continuous innovation and optimization at the technical level but also corresponding adjustments in educational concepts and methods. By combining practice with theory, fully applying new productive forces, and continuously expanding the application scenarios of LLM, the sustained high-quality development of university civic education can be ensured.

Acknowledgement

Project Funding: Shanxi Province 2023 Ideological and Political Work Project - Research on the Methodology of Empowering College Ideological and Political Education with Artificial Intelligence Content Generation (AIGC) 23SXSZ0140.

References

1. X. Li, Y. Wang, and L. Cheng, ‘‘Seq-CNN: A lightweight and efficient neural network for sentimental analysis of text,’’ in Proc. 3rd Int. Conf. Data Sci. Comput. Appl., Oct, pp. 434–438. (2023)
2. A. Vaswani, ‘‘Attention is all you need,’’ in Proc. 31st Int. Conf. Neural Inf. Process. Syst. (NIPS), Long Beach, CA, USA, Jun, pp. 1–12. (2017)
3. E. Kasneci, ‘‘ChatGPT for good? On opportunities and challenges of large language models for education,’’ Learn. Individual Differences, vol. 103, Apr. (2023)
4. S. Milano, J. A. McGrane, and S. Leonelli, ‘‘Large language models challenge the future of higher education,’’ Nature Mach. Intell., vol. 5, no. 4, pp. 333–334, Mar. (2023).
5. The Simon Initiative. (2024). Open Learning Initiative. Carnegie Mellon University. Accessed: Dec. 1, 2023 [Online]. Available: https://www.cmu.edu/simon/open-simon/toolkit/tools/learningtools/oli.html.
6. S. Koric. (2023). Utilizing AI and Machine Learning for Accelerated Data Generation and Training in Research Engineering With Computers. Accessed: Jan. 5, 2024. [Online]. Available: https://mechse. illinois.edu/news/56740.
7. A. Goel. (Jan. 24, 2020). Georgia Institute of Technology. Accessed: Jan. 10, 2024. [Online]. Available: https://research.gatech.edu/jill-watsonai-pioneer-education-turns-4.
8. A. Stapleton. (Dec. 22, 2023). Academia Insider. Accessed: Jan. 4, 2024. [Online]. Available: https://academiainsider.com/ai-tools-to-automateyour-literature-review-which-to-use/8.

9. L. B. Cavagnaro. (Oct. 5, 2022). Stanford Digital Education. Accessed: Dec. 1, 2023. [Online]. Available: https://digitaleducation.stanford.edu/ chatbot-guides-students-learn-and-reflect.
10. S. Koperniak. Bringing Artificial Intelligence and MIT To Middle School Classrooms. Accessed: Jan. 4, 2024.https://news.mit.edu/2019/bringing-artificial-intelligence-and-mitmiddle-school-classrooms-1230.
11. Goli. Unleashing the Next Chapter of Personalized and Interactive Online Learning With Generative AI, Machine Learning, and Virtual Reality. Accessed: Jan. 3, 2024. [Online]. Available: https://blog.coursera.org/newproducts-tools-and-features-2023/.
12. Harvard University. Library Innovation Lab. Accessed: Dec. 9, 2023. (2024). [Online]. Available: https://lil.law.harvard.edu/about/ai/.
13. Arizona State University. ASU Machine Learning & AI MicroBootCamp. Oct. 7, (2023).
14. M. Hart. Incubating Innovation At Southern New Hampshire University. Campus Technology. Jan. 3, (2024).
15. Pan, L., Zhou, P.: Reconstruction of Teacher-Student Relationship under Intelligent Ideological and Political Education: Learning Community. Research on Ideological and Political Courses (05), 141–149 (2023).
16. Skenderi, F., Skenderi, L.: Fostering Innovation in Higher Education: Transforming Teaching for Tomorrow. KNOWLEDGE-International Journal 60(2), 251–255 (2023).
17. Lu, Y.: Practical Innovation of Students' Civic Education Model Based on Artificial Intelligence Technology. Applied Mathematics and Nonlinear Sciences 9(1), 1–10 (2024). 17.
18. Zhu, J.: Innovative Exploration of the Integration Path of Artificial Intelligence Ethics and College Students' Ideological and Political Education. Applied Mathematics and Nonlinear Sciences 9(1), 1–10 (2024).