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The Challenges of AI Digital Textbook Adoption in Korea's Social Studies Education

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Abstract

This paper explores the challenges and opportunities associated with the adoption of AI digital textbooks in South Korea's social studies education. While AI technologies promise personalized learning and improved engagement, concerns remain regarding bias, the transformation of teacher roles, equitable access, and the ethical design of content. Drawing on recent research and national policy initiatives, this study examines prototype implementations, research findings, and systemic implications to outline critical directions for successful integration. The paper argues that AI digital textbooks must be designed to support balanced and critical social studies learning and suggests practical strategies for teacher training and stakeholder collaboration.
Keywords: AI digital textbooks, Social studies education, Personalized learning, Teacher training, Education policy

Introduction

The Intersection of Artificial Intelligence and Education

The 21st century is an era of technological innovation. The advancement of digital technologies and the integration of artificial intelligence (AI) into various sectors have brought significant changes to everyday life and industries worldwide. AI is particularly recognized as an innovative technology that complements or replaces human abilities in information processing and decision-making. Already widely used in healthcare, finance, and manufacturing, AI is becoming increasingly important in education.

The adoption of AI in education is transforming students' learning experiences. Traditionally, education relied heavily on uniform teaching methods like lectures. However, AI plays a crucial role in transitioning to personalized learning. AI technologies analyze individual students' learning patterns and performance to provide tailored educational experiences. For instance, AI can identify when a student struggles with a specific concept and promptly offer additional resources or exercises to aid comprehension.

AI also leverages learning data to identify students' strengths and weaknesses, optimizing learning pathways. This reduces the time teachers spend monitoring and adjusting individual learning progress, enabling

students to learn at their own pace and ability level. Such applications are particularly effective in narrowing learning gaps and ensuring equal educational opportunities for all students.

Recognizing AI's potential, many countries are incorporating AI into their education systems. For example, the United States and China have developed AI-driven educational platforms to provide personalized learning experiences and improve academic outcomes. South Korea is also actively embracing this global trend, investing significantly in developing AI digital textbooks.

The Background of South Korea's AI Digital Textbook Initiative

The South Korean government has identified AI as a key component of future education, aiming to dramatically enhance educational quality. Recognizing the need to transform the education system to address societal changes such as low birth rates and population decline, the introduction of AI digital textbooks has emerged as a critical strategy to reduce educational disparities and provide personalized learning for all students.

AI digital textbooks will be piloted in 2025 in subjects such as mathematics, English, computer science, and Korean, with plans to expand to all major subjects, including social studies, science, and history, by 2028. These textbooks analyze real-time learning data to create personalized learning pathways. For example, AI can automatically detect areas where students struggle, offer supplementary materials, or provide content aligned with their learning pace. This maximizes learning effectiveness and helps students progress at a comfortable pace.

Purpose and Structure of the Study

This study aims to critically examine the adoption of AI digital textbooks in South Korea's social studies education, focusing on both the opportunities they present and the challenges they entail. While AI offers powerful tools for personalized learning and student engagement, its implementation in subjects like social studies—where understanding diverse perspectives and fostering critical thinking are essential—requires careful consideration. The research explores how AI digital textbooks are currently being designed and implemented, how they align with or disrupt traditional pedagogical practices, and what implications they carry for teaching roles, ethical responsibility, and equitable access. Drawing upon national policy documents, classroom-based research, and recent prototype evaluations, this paper seeks to provide a comprehensive understanding of the educational, technological, and ethical dimensions of AI integration in social studies. Through this analysis, it proposes practical strategies and directions to support the meaningful and balanced use of AI in fostering thoughtful, critically minded citizens.

The Background of AI Digital Textbook Adoption in South Korea

The Necessity of Digital Educational Innovation

The adoption of AI digital textbooks is an essential step in accelerating the digital transformation of South Korea's education system. In its "Digital Education Innovation Plan," announced in early 2023, the Ministry of Education emphasized AI-based personalized learning. This plan aims to address declining student populations caused by low birth rates and to reduce educational disparities, ensuring that every student receives education tailored to their abilities.

The Ministry of Education plans to begin implementing AI digital textbooks in 2025 and expand them to all major subjects by 2028. This initiative is expected to offer students personalized learning experiences based on their individual abilities, significantly narrowing learning gaps. Social studies, in particular, involves complex societal issues, and the integration of AI is anticipated to play a vital role in enhancing students' understanding.

The Current Status of AI Digital Textbook Implementation

To achieve educational innovation, the South Korean government has established a phased plan for introducing AI digital textbooks. Starting in 2025, these textbooks will be piloted in subjects like mathematics, English, computer science, and Korean (special education) and gradually expanded to social studies, history, and science by 2028. This plan is supported by various initiatives aimed at ensuring the seamless integration of AI digital textbooks into classrooms. For instance, the "AI digital Textbook Implementation Plan," released in June 2023, includes specific strategies to support the effective use of these textbooks in education.

What do AI digital textbooks look like in practice? Their most notable feature is the ability to analyze individual students' characteristics and learning conditions to deliver personalized education. Through dashboards, students, teachers, and parents can access detailed learning data analysis, fostering effective communication among all stakeholders. To facilitate this, nationwide wireless networks have been established, and single sign-on systems have been introduced for easy access.

For students, AI digital textbooks provide initial learning diagnostics and analysis to recommend the most suitable learning pathways and content. They also offer tailored learning support through AI tutors. For teachers, the system aids in lesson planning and allows for the customization of content, making it easier to monitor and address individual student needs with the help of AI teaching assistants. Teachers can also manage students' learning histories and emotional states using data-driven evidence.

To achieve these goals, the South Korean government plans to invest approximately 70 billion won (about 70 million USD) in 2024 alone to improve educational infrastructure related to AI digital textbooks. This budget will be allocated to enhancing school network infrastructure, providing digital devices, and improving overall digital learning environments. Additionally, the Ministry of Education has earmarked 60 billion won for upgrading networks in 6,000 schools and plans to deploy 1,200 digital tutors and establish technical support centers to help teachers effectively utilize AI digital textbooks (Ministry of Education, 2023).

Such large-scale investments are expected to play a pivotal role in ensuring the successful adoption of AI digital textbooks and improving the quality of education. This initiative is more than a technological innovation—it is a crucial step toward enabling students to maximize their learning outcomes through personalized education tailored to their abilities.

AI Digital Textbook Prototypes

In late 2023, prototypes of AI digital textbooks were briefly introduced. The introductory sections of these prototypes included content from previous lessons on input and output, showcasing how diagnostic evaluations could be conducted using AI digital textbooks. One of the standout features was the ability to diagnose and analyze students' learning conditions in real-time. For instance, students who required remedial learning could engage in additional practice, while others could proceed directly to conceptual learning and practical activities.

Formative assessments, practice exercises, and self-assessments were seamlessly integrated into the AI digital textbook, allowing for comprehensive student activity analysis.

An additional advantage was the inclusion of AI tutors within the textbooks. These tutors provided solutions to students' challenges by offering relevant resources. For example, when planning a geographical field trip, students struggling to identify specific locations or determine optimal routes could seek assistance from the AI tutor, which supplied helpful information.

Dashboards also allowed teachers to monitor students' progress and comprehension levels at a glance, making it easier to identify and address gaps in understanding.

Application of AI in South Korean Social Studies Education

In South Korea, the application of artificial intelligence (AI) in social studies education has been the focus of growing academic interest, particularly in the wake of rapid advancements in educational technology. Recent studies highlight how AI tools, including digital textbooks, chatbots, and generative AI models like ChatGPT, are influencing both teaching practices and student learning outcomes. These technologies are not simply supplemental; rather, they represent a fundamental transformation in the way knowledge is delivered, accessed, and internalized in the classroom.

A review of major studies published between 2023 and 2024 reveals common themes around personalization, interactivity, and critical thinking. A word cloud analysis of key terms from selected research identified words such as "elementary," "utilization," "development," "citizen," and "learning," emphasizing the strong presence of AI applications in elementary education and their alignment with goals in social studies, such as civic understanding and problem-solving.

Several notable studies illustrate the diverse ways AI is being integrated into social studies instruction. For example, Sung and Park (2024) examined how generative AI like ChatGPT can support students in exploring complex social issues by presenting multiple perspectives, thereby fostering creativity and critical thinking. Moon (2024) investigated how pre-service teachers designed AI-supported lessons and emphasized the need for proper training in AI pedagogical integration. Jung and Ma (2023) implemented an AI chatbot-based program in elementary social studies classes, which resulted in increased student engagement and improved learning outcomes. Park (2023) addressed ethical concerns regarding algorithmic bias in AI-generated educational content, advocating for the development of critical literacy among both students and teachers. Lee et al. (2023) surveyed secondary social studies teachers, revealing a generally positive outlook toward AI, coupled with a strong demand for structured professional development.

Collectively, these studies underscore that AI is not merely a technical tool but a catalyst for pedagogical transformation. It enables more personalized and adaptive learning experiences, helping students to learn at their own pace and according to their individual needs. For teachers, AI offers new ways to design, deliver, and assess instruction, shifting their role from knowledge transmitters to facilitators and learning coordinators. At the same time, the adoption of AI raises important issues related to ethics, data bias, and teacher preparedness, which must be addressed through thoughtful curriculum design and targeted teacher training.

As South Korea continues to invest in AI-based educational infrastructure, including the nationwide rollout of AI digital textbooks, these findings offer important insights into how social studies education can adapt

to the evolving digital landscape. AI's potential to support critical thinking, close learning gaps, and promote equitable access to education makes it a powerful force for innovation—if used thoughtfully and responsibly.

Challenges in Social Studies Education

Bias and Ethical Issues in AI

The use of AI in education brings challenges related to bias and ethics. Park (2023) warns that if AI learns from biased datasets, it may distort the fair understanding of diverse perspectives in social studies classes. This issue is particularly evident in technologies like generative AI, Large Language Models (LLMs), and Retrieval-Augmented Generation (RAG), as these models rely on pre-existing data, which can inadvertently reflect inherent biases.

Generative AI and LLMs are trained on vast amounts of textual data, which may include culturally, socially, or ideologically biased information. Such biases can influence the text these models generate, potentially hindering a balanced understanding in social studies education. For example, when discussing historical events or social issues, biased perspectives might be presented as facts, making it difficult for students to achieve a well-rounded understanding of multiple viewpoints.

RAG, which combines information retrieval with generative AI, can produce highly detailed responses. However, the accuracy and fairness of these outputs depend heavily on the quality and impartiality of the retrieved information. If the sources are not sufficiently vetted or fail to reflect diverse perspectives, the generated responses may contain incomplete or distorted information.

To address these issues, ensuring the diversity and fairness of AI training datasets is essential. AI systems used in educational settings must incorporate data from a wide range of sources and perspectives, and the quality and reliability of this data should be continually reviewed. Moreover, it is crucial to equip teachers and students with the skills to critically analyze AI outputs. Instead of accepting AI-generated information uncritically, they should be encouraged to evaluate and interpret it from multiple perspectives.

Additionally, AI digital textbooks must be closely monitored to assess their impact on learners, with mechanisms in place for timely corrections and improvements. For instance, when bias is detected in AI systems, swift corrective actions should be implemented to mitigate any negative effects. Establishing such processes is critical to ensuring that AI continues to have a positive influence in educational settings.

Changing Roles of Teachers and the Need for Training

The adoption of AI digital textbooks is transforming the role of teachers in social studies education. Teachers are no longer just knowledge transmitters but are now expected to use AI to adjust and support individual students' learning pathways. This change is particularly significant in social studies, where fostering critical thinking and an understanding of diverse perspectives is paramount.

Lee *et al*. (2023) emphasized the need for training programs to prepare teachers for these evolving roles. Social studies teachers must effectively utilize AI-generated data to design tailored lessons and closely monitor students' learning progress. This enables a deeper understanding of societal and historical issues while ensuring a balanced education that considers diverse viewpoints.

In AI-integrated education, teachers play a crucial role in interpreting AI-provided information and

analysis to plan individualized learning pathways and adjust educational directions as needed. Therefore, teachers must acquire a thorough understanding of AI functionalities and their practical applications in the classroom. Training programs should focus not only on technical skills but also on equipping teachers to anticipate and address potential educational challenges arising from AI use.

Recognizing this necessity, the Ministry of Education plans to implement intensive training programs for teachers in AI-integrated subjects starting in 2025. These programs will cover foundational AI concepts, lesson planning using AI digital textbooks, and practical classroom applications. Such training will help teachers proactively address potential issues associated with AI adoption and support students' learning more effectively.

These training programs must also offer continuous support and updates. As AI technology evolves rapidly, teachers need to stay updated with new methods and innovations. To facilitate this, the Ministry of Education plans to establish online learning platforms for teachers, offering the latest educational resources and training content. This ongoing support will enable teachers to successfully fulfill their roles in AI-enhanced classrooms.

Opportunities and Risks of Personalized Learning

AI digital textbooks enable personalized learning in social studies education, tailoring content to each student's level and pace. While this optimizes educational outcomes and maximizes learning potential, it also carries the risk of widening disparities in understanding social and historical issues among students. For instance, faster learners may benefit from advanced content with AI support, while slower learners may remain stuck repeating foundational concepts. This could result in significant differences in critical thinking skills and the ability to grasp diverse perspectives necessary for tackling complex issues in social studies.

To mitigate such risks, AI systems must be designed to apply equitably to all students. In particular, the personalized learning content provided by AI in social studies education should be structured to minimize disparities among learners. AI systems should consider students' diverse backgrounds and abilities to provide optimal learning pathways while ensuring balanced education on social and historical issues.

Furthermore, additional support programs should be introduced to assist slower learners and reduce learning gaps in social studies. For example, social studies teachers can use AI-generated analyses to provide personalized guidance to individual students or offer additional learning opportunities through after-school programs. These supplemental initiatives are crucial to ensuring that all students benefit equally from AI digital textbooks.

Changing Roles of Students and Parents

The introduction of AI digital textbooks is also changing the roles of students and parents in social studies education. Students can now use AI to set their own learning pathways and take a more active role in their education. In social studies, where self-directed learning about various societal and historical issues is essential, AI serves as an effective tool to support this process. It helps students develop self-directed learning habits and facilitates a deeper understanding of complex issues.

For parents, AI digital textbooks allow real-time monitoring of their children's progress and achievements in social studies. This enables parents to better understand their children's learning situations and provide appropriate support when needed. Additionally, AI-generated data can help parents guide their children's

academic and career planning based on their interests and abilities in societal and historical topics.

These changes enhance interactions between parents and students, providing parents with more opportunities to actively participate in their children's social studies education. To maximize the benefits of these changes, parents should be effectively informed about the role of AI digital textbooks and supported in creating a structured learning environment at home.

Opportunities in Social Studies Education

Innovation in Educational Methods

The introduction of AI offers significant opportunities for innovation in teaching methods in social studies education. As social studies inherently deal with complex social phenomena and historical events, there is a pressing need for new methods to help students understand and engage with such content more deeply. AI technology meets this demand by creating immersive and exploratory learning environments for students.

For instance, historical events can be recreated through AI-based simulations, allowing students to vividly experience key moments from the past. These simulations not only help students memorize facts but also enable them to analyze causes and consequences within historical contexts, gaining a multi-perspective understanding of their significance. Similarly, economic models can be visualized using AI, aiding students in comprehending intricate economic principles and societal changes more clearly.

Leveraging AI technology enhances student engagement and enables deeper understanding of the material. Social issues and historical events addressed in social studies can sometimes be abstract, but visual materials and simulations provided by AI make these concepts more tangible and practical. This approach helps students formulate opinions and develop critical thinking skills.

Additionally, AI can serve as a tool to present diverse perspectives. It can offer multiple interpretations of an event or compare viewpoints from individuals with different cultural backgrounds. This fosters students' ability to view issues from various angles and strengthens their critical thinking skills when analyzing complex social problems. Thus, the integration of AI in social studies education aids students in understanding diverse perspectives and developing a global outlook.

Strengthening Student-led Learning

AI empowers students to take a more active role in their learning process. In social studies education, the ability to set learning goals and manage one's learning trajectory is crucial. By providing content tailored to students' preferences and abilities, AI supports self-directed learning, boosting students' motivation and maximizing learning outcomes.

In AI-based learning environments, students can create their own learning plans and proceed according to their schedules. For example, a student can select content that aligns with their interests and proficiency levels from the options recommended by AI. This personalized learning enables deeper engagement with the material and efficient study methods tailored to individual learning styles. AI also analyzes students' performance in real-time, adjusting learning pathways or recommending additional resources as needed.

This approach enhances students' sense of responsibility and helps them develop self-directed learning habits. By managing their learning processes independently, students develop ownership of their education,

which in turn motivates them to achieve their goals. In social studies, AI digital textbooks can serve as a vital tool, enabling students to explore complex social issues while cultivating critical thinking and problem-solving skills.

Expanding Social Interaction

AI digital textbooks go beyond being individual learning tools and play a crucial role in enhancing social interaction among students. In social studies education, the ability to understand diverse perspectives and collaborate effectively is vital, and AI can act as a catalyst in promoting such interactions. For example, AI-enabled collaborative learning environments allow students to share different perspectives and work together to solve problems, thereby acquiring essential social skills.

AI-based platforms offer opportunities for students to participate in online discussions or undertake joint projects. In such collaborative learning environments, students learn to respect each other's opinions and develop problem-solving skills through teamwork. This fosters a deeper understanding of complex issues in social studies through enriched discussions and cooperation.

Moreover, AI can facilitate interactions between students from different schools or regions. Through these exchanges, students can engage with peers from diverse backgrounds, broadening their global perspective. Such experiences lay the foundation for effective communication and collaboration in the future global society. Expanding interaction is especially essential in social studies education to understand international issues and diverse cultural contexts, and AI serves as a key tool to achieve this goal.

Conclusion

The adoption of AI digital textbooks in South Korea is expected to bring transformative changes to social studies education. AI enables personalized learning, making the learning experience more efficient and effective. However, to successfully implement these changes, several challenges must be addressed.

First, issues of bias and ethics in AI digital textbooks need to be resolved. As AI relies on data for learning, biased datasets can lead to the propagation of misinformation or excessive emphasis on specific perspectives. To mitigate these risks, it is essential to ensure diversity and fairness in the data used by AI, enabling balanced comprehension of various viewpoints for learners.

Second, the role of teachers must be redefined. With AI playing a central role in the learning process, teachers are transitioning from mere knowledge transmitters to coordinators who adjust and support individual students' learning. Teachers must acquire the necessary skills to effectively use AI, supported by continuous training and resources. The shift in teachers' roles is a critical factor in determining the success of AI implementation, requiring active support from the Ministry of Education and schools.

Third, measures must be taken to minimize learning disparities among students. While AI digital textbooks offer personalized learning tailored to individual students' pace and abilities, this can inadvertently widen gaps between students. To prevent this, AI learning pathways must be equitably designed for all students, and additional support programs for slower learners should be introduced. These programs can be implemented through support teachers, after-school programs, and online platforms.

Fourth, the roles of students and parents must evolve. With the introduction of AI digital textbooks,

students can take charge of their learning, and parents can monitor their children's progress in greater detail. Parents should actively participate in their children's education and provide appropriate support when necessary. Students, in turn, must cultivate self-directed learning attitudes and develop the ability to achieve their goals using AI tools.

Finally, strategies to promote social interaction through AI digital textbooks must be explored. AI should not only provide personalized learning experiences but also foster collaborative learning and social interaction among students. Establishing AI-based collaborative learning environments and encouraging students to share perspectives and solve problems collectively are essential steps. These interactions are crucial for developing students' social skills and preparing them to effectively communicate and collaborate in a global society.

To address these challenges and ensure the successful implementation of AI digital textbooks, collaboration among government bodies, educational institutions, teachers, parents, and students is essential. To fully realize AI's potential for transformative change in social studies education, all stakeholders must work together.

The introduction of AI digital textbooks in South Korea marks not just a technological shift but also a redefinition of education's essence, paving the way for future-ready learning environments. This advancement will enable social studies education in South Korea to reach new heights and fully utilize the opportunities AI provides to enrich students' learning experiences. In the educational landscape of the future, AI will not merely be a tool but a vital partner in fostering students' creative and critical thinking abilities.

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