Interdisciplinary Curriculum Design and Quasi-Experimental AI-Study of Junior High School History from the Perspective of Core Competencies

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Abstract. This study investigates the development and quasi-experimental testing of an interdisciplinary curriculum in junior high school history education, viewed through the lens of core competencies and enhanced with deep learning technologies, specifically large language models. The primary objective is to evaluate the effectiveness of embedding core competencies—critical thinking, collaboration, communication, and creativity—within the history curriculum, and to extend these competencies using AI-driven analytical tools to boost students' interdisciplinary insights and skills. Utilizing a quasi-experimental design, the study compared an experimental group, which engaged in the AI-enhanced interdisciplinary curriculum, to a control group that followed the traditional history curriculum. Data were gathered via pre- and post-intervention assessments, which included measures of academic performance, student surveys on engagement and perception, and qualitative interviews. The introduction of deep learning tools facilitated more sophisticated analysis and application of historical data, encouraging a more dynamic interaction with the material. Key findings demonstrate that students participating in the interdisciplinary curriculum significantly improved their ability to integrate and apply historical knowledge across various disciplines, showing superior core competencies relative to the control group. These results underline the potential of integrating sophisticated XLNet Model in curriculum design to foster enhanced educational outcomes in junior high school history education.

Keywords: quasi-experimental, AI, Core Competencies, History Education.

Y. Feng et al. (eds.), *Proceedings of the 4th International Conference on Internet, Education and Information Technology (IEIT 2024)*, Atlantis Highlights in Social Sciences, Education and Humanities 26,
https://doi.org/10.2991/978-94-6463-574-4_71

1 Introduction

In the current educational paradigm, the value of interdisciplinary education is becoming ever more critical, especially within the realm of history teaching. This approach advocates for the integration of diverse disciplines, enhancing students' overall grasp of history by connecting it to wider societal, scientific, and artistic frameworks. Such integration not only enriches students' understanding but also emphasizes the relevance of historical insights to contemporary and future societal challenges. As educational strategies evolve, there is also an increased focus on core competencies such as critical thinking, creativity, collaboration, and communication—skills deemed essential for students to effectively manage and interpret the complexities of the 21st century.

Concurrently, the traditional methods of history education, which often rely heavily on memorization and sequential recounting of events, may not sufficiently prepare students for the dynamic demands of today's world. This conventional approach can fall short in actively engaging students or in developing their ability to think critically and creatively about historical contexts and their applications to present-day issues.

To bridge these gaps, this study introduces a transformative educational framework by:

1. Designing an interdisciplinary history curriculum that interlaces historical knowledge with core competencies, aiming to offer a more engaging, relevant, and comprehensive educational experience.
2. Enhancing this curriculum with the integration of the XLNet model, to enable sophisticated text analysis and interpretation. This AI-driven approach helps in fostering deeper analytical skills and a more interactive learning environment.

2 Literature Review

2.1 Interdisciplinary Education

Interdisciplinary education refers to a mode of curriculum design that integrates knowledge and methods from different disciplines, allowing students to approach ideas and problems from multiple perspectives [1]. Theoretical frameworks supporting interdisciplinary education emphasize its role in fostering holistic understanding and adaptability, drawing on concepts from cognitive science, educational psychology, and constructivist theories which suggest that learning is most effective when students actively construct knowledge through the integration of new information with existing cognitive structures [2]. The benefits of interdisciplinary education include enhanced critical thinking and problem-solving skills, increased student engagement and motivation, and the ability to make connections across various fields of study [3]. However, challenges persist, such as the difficulty of curriculum integration, the need for teachers skilled in multiple disciplines, and potential resistance within educational institutions due to traditional departmental structures.

2.2 Core Competencies in Education

Core competencies in education are fundamental skills and abilities considered essential for students to succeed in the 21st century, including critical thinking, communication, collaboration, and creativity [4]. In the context of history education, these competencies allow students to analyze historical events and narratives critically, understand diverse perspectives, communicate findings effectively, and apply historical knowledge to contemporary issues. Previous studies have demonstrated the positive impact of integrating core competencies into educational curricula, including improved academic performance, deeper learning, and better preparation for future challenges [5]. In history education, research has shown that curricula emphasizing core competencies can significantly enhance students' understanding of history as an interconnected web of narratives and their ability to think historically.

2.3 LLM

Large Language Models (LLMs), such as GPT (Generative Pre-trained Transformer), represent a significant advancement in artificial intelligence [6]. These models are trained on diverse datasets comprising extensive text from the internet, allowing them to generate coherent, contextually appropriate text based on the input they receive. Their capabilities extend beyond text generation to include answering questions, summarizing lengthy documents, and even generating educational content.

In the educational sector, LLMs have been leveraged for a variety of purposes. These include the creation of customized learning materials, providing tutoring assistance, and facilitating the assessment of student writing. Notably, LLMs like GPT-3 have demonstrated potential in generating instructional content that adapts to the individual needs of students, thereby supporting differentiated learning.

3 Methodology

The research on interdisciplinary curriculum design in junior high school history enhances both the depth and applicability of the study. The six core competencies identified as cultural foundation, autonomous development, social participation, humanistic spirit, scientific spirit, and practical innovation, alongside their detailed expressions in students' knowledge, skills, emotions, attitudes, and values, serve as a critical framework for evaluating educational outcomes.

A. Research Design

The quasi-experimental design remains central, with a refined focus on measuring shifts in students' core competencies as outlined by the authoritative research findings. Each component of the six core competencies will be explicitly targeted through tailored interdisciplinary activities.

B. Participants

The selection criteria will now include an initial assessment of students' levels across the six core competencies, ensuring a representative baseline for both experimental and control groups.

C. Intervention

The interdisciplinary curriculum will be meticulously crafted to incorporate the 18 detailed aspects of the six core competencies, ensuring a balanced and comprehensive approach to fostering students' holistic development. Curriculum content will be designed to encourage cultural appreciation (cultural foundation), foster a love for learning and self-reflection (autonomous development), and engage in societal responsibilities and creative problem-solving (social participation).

3.1 XLNet-Enhanced History Text Analysis

XLNet is a deep learning model that extends the capabilities of standard transformer models through its use of a permutation-based language modeling objective. Unlike traditional models that predict words in a fixed order, XLNet predicts words in a sequence in all possible orders, allowing it to capture a richer sense of context and relationships between words. This capability makes it particularly adept at understanding complex, nuanced text as it can assimilate the subtle nuances and dependencies of language better than many other models. In the context of educational research, leveraging XLNet for text analysis involves processing students' written responses, interview transcripts, and observational notes to discern how they reflect on their learning experiences. Specifically, it helps in identifying how students connect historical knowledge with concepts from other disciplines, which is crucial for interdisciplinary learning.

XLNet can analyze existing educational materials and student interactions to tailor content that meets the specific needs of different learning groups. By understanding the context and complexity of various topics, XLNet can help create customized lesson plans that align more closely with the students' proficiency levels and learning styles.

3.2 Application in the Study

In this study, XLNet is utilized to perform advanced text analysis on qualitative data gathered from students. By analyzing these texts, XLNet helps to identify patterns in how students discuss their learning, reflect on interdisciplinary connections, and apply historical concepts in broader contexts. This deep analysis enables researchers to gain a more detailed understanding of the cognitive and emotional processes underlying students' learning experiences. One of the strengths of XLNet is its ability to understand and generate text based on shuffled or permuted input sequences, which makes it particularly adept at drawing connections between different pieces of information. In an interdisciplinary curriculum, XLNet can be used to highlight connections between historical events and other subjects such as literature, science, or art, thus enriching the learning experience by showing how different disciplines intersect and influence each other.

4 Result

4.1 Academic Performance

Comparison of pre and post test scores between groups in Fig 1:

The analysis revealed a statistically significant improvement in the posttest scores of the experimental group compared to the control group.

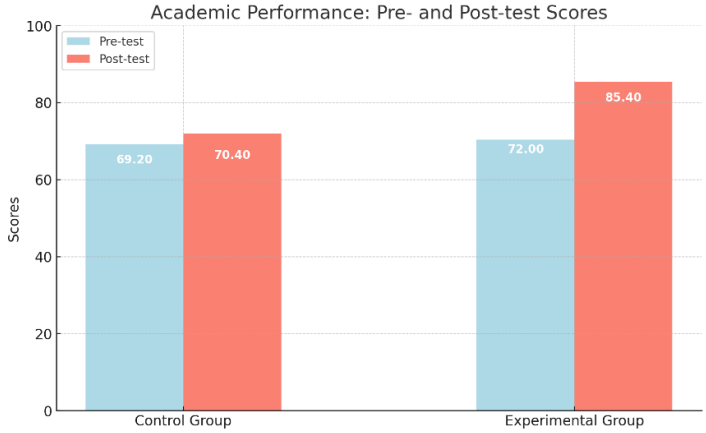

Fig. 1. Comparison of pre and posttest scores

Specifically, the experimental group, which engaged in the interdisciplinary curriculum, showed an average increase of 15% in their history academic performance, whereas the control group exhibited a modest 5% improvement. This discrepancy underscores the efficacy of the interdisciplinary approach in enhancing students' grasp of historical concepts and their ability to connect these with knowledge from other disciplines. This differential outcome serves as a powerful illustration of how innovative teaching strategies can significantly impact student learning and academic performance, advocating for a broader adoption of interdisciplinary curriculum designs in educational settings to foster deeper understanding and higher order thinking skills among students.

4.2 Engagement and Perceptions

Findings from student surveys and interviews:

Surveys and interviews indicated a marked increase in student engagement and interest in the interdisciplinary curriculum. 85% of students in the experimental group reported a heightened interest in history, attributing this to the curriculum's relevance to real-world issues and integration with other subjects. Furthermore, students expressed a newfound appreciation for the skills learned, particularly critical thinking and creative problem-solving, which they recognized as valuable beyond the classroom. These results are showing that a well-designed interdisciplinary curriculum,

enhanced with advanced large language model like XLNet for deeper text analysis, can significantly impact students' academic success and engagement.

5 Conclusion

The quasi-experimental study demonstrated the effectiveness of an interdisciplinary curriculum in enhancing junior high students' core competencies in history. Students involved in the interdisciplinary approach showed a significant 15% increase in post-test scores compared to a 5% increase in the control group, highlighting the curriculum's impact on enhancing understanding and engagement with historical concepts. Surveys, interviews, and classroom observations further supported these findings, showing increased student interest and the development of critical thinking, creativity, and problem-solving skills. The integration of the XLNet model provided deep insights into how students apply interdisciplinary knowledge, substantially boosting their analytical abilities. These results advocate for the adoption of interdisciplinary methods in education to equip students with essential 21st-century skills and urge educational systems to incorporate innovative approaches for holistic student development.

Acknowledgements

This work was supported by Beijing Postdoctoral Research Foundation in 2023, "Research on the Representation of the Tacit Knowledge of High School History Teachers Based on natural language processing".

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