A Study on the Innovation of Chinese Language and Literature Teaching Based on Geospatial Narrative: Taking the Geographical Background Analysis of Regional Literary Works as a Path

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ABSTRACT Current Chinese language and literature teaching emphasizes the geographical background of regional works, but students often lack a deep understanding of spatial imagery, cultural clues, and character psychology, resulting in limited teaching effectiveness. Based on geospatial narrative theory, this paper constructs a three-dimensional teaching model integrating literary text, geographical space, and cultural cognition. Through geographical analysis of regional literary works, the model activates students' spatial thinking and cultural perception. The research process includes selecting classic regional literary works such as Border Town and Ordinary World, using geographic information systems to identify geographical elements and generate narrative maps, designing geography-driven instructional tasks to examine textual origin, spatial imagery, and cultural representation, and conducting teaching experiments to compare experimental and control classes across literary comprehension, spatial imagination, and cultural cognition. The experimental class shows a 23.5% improvement in text comprehension, a 31.2% improvement in spatial perception, and a 28.7% improvement in cultural cognition, all significantly higher than the control class ($P < 0.01$). The results show that geospatial narrative teaching can effectively improve spatial cognition and literary understanding.

INDEX TERMS geospatial narrative, regional literature, chinese literature teaching, gis application, spatial cognition

I. INTRODUCTION

A. RESEARCH BACKGROUND

READING comprehension in Chinese language and literature teaching often focuses on the meaning of the text, neglecting its spatial narrative structure. Regional literature narratives rely on specific geographical environments, including the local landscapes and spatial patterns that shape character psychology, plot progression, and the generation of cultural imagery. The integration of regional weaving traditions and fabric textures into these settings provides a tangible framework for understanding the characters' socioeconomic realities and the symbolic depth of the literary world. Works like Border Town and Ordinary World demonstrate the mapping between regional conditions, social structures, and emotional expression. However, text teaching often focuses solely on linguistic style and plot analysis, failing to incorporate the influence of geographical space into narrative analysis. With the continuous development of educational information technology, the visualization of literary space has become possible. Geospatial narrative theory can explain the spatial structure of literary texts and utilize a geographic information system (GIS) to quantify and dynamically express locations, paths, and spatial symbols within the text. Research on literary space based on this theoretical perspective can utilize digital means to establish spatial maps and semantics of literary texts digitally, enhancing structured literary understanding and multidimensional cultural perception.

B. EXISTING PROBLEMS AND CHALLENGES

In current literature teaching, teachers lack awareness of spatial data in text analysis, and teaching content mainly consists of text and static images, failing to demonstrate the spatiotemporal relationships in literary works. When students read regional literature, their understanding of geographical background is largely subjective and their perception of the relationship between space and narrative entities is inaccurate. Teaching activities lack quantifiable

process data, making it impossible to measure students' understanding of spatial narratives. A technological gap exists between literary research and spatial analysis tools. Although GIS platforms support spatial annotation, path tracing, and narrative map generation, literature teachers still face a high technical threshold in using them for text semantic extraction, which prevents the formation of a closed-loop teaching structure aligned with instructional objectives. Regarding the establishment of interdisciplinary research programs, there is a lack of spatial data models for optimizing literary semantic features, and the mapping rules between symbolic geographical symbols in works and real geographical structures have not been standardized. This separation between teaching and technology is a bottleneck restricting breakthroughs in teaching innovation.

C. SIGNIFICANCE OF THE RESEARCH

This study proposes a geospatial narrative–driven instructional framework for Chinese language and literature by integrating GIS technology and exploring a feasible mechanism for the convergence of humanities and spatial information science. The significance of this research is threefold: at the instructional level, it implements an integrated model connecting literary text, geospatial representation, and cultural cognition; it develops a computable literary structural model to analyze the spatial logic of narrative through data-driven methods; and it employs spatial information visualization systems to support classroom teaching by tracing plot trajectories and locations, thereby enhancing students' abilities in literary analysis and cultural interpretation. Experimental data verifies the teaching effectiveness by providing interdisciplinary technological solutions that integrate cultural heritage into Chinese language and literature education, offering a new research paradigm for applying geographic information technology to map the spatial distribution of humanities. This approach validates how digital tools can visualize the evolution of regional fabric traditions alongside literary development to enhance pedagogical outcomes.

II. RELEVANT RESEARCH AND THEORETICAL BASIS

A. OVERVIEW OF GEOSPATIAL NARRATIVE THEORY

Geospatial narrative is an important component of narrative entities, emphasizing the interaction between plot, character behavior, and geographical environment. This theory is derived from the spatial representation of human geography and later extended by cultural geography and cognitive narratology [1,2]. Its core idea is that literary narrative is not only a continuous process of linguistic clues, but also a perceptible structure of spatial paths. Scholars analyze the migration of narrative paths, spatial markers, and the formation mechanism of emotional geography by establishing the mapping relationship between text and geographical elements [3]. Western scholars combine geospatial narrative with map semantics through digital humanities to form a visualized text reconstruction path [4,5]. Domestic scholars focus on studying local literature and spatial identity from the perspective of cultural geography. Geospatial narrative can provide a new structure for literary teaching, enabling the teaching of works to shift from linear explanation to spatial topological cognitive construction, focusing on the projection of geographical reality and the psychological migration of the narrative subject in spatial perception, and has the potential for computational visualization.

B. CURRENT STATUS OF RESEARCH ON LITERARY SPATIAL NARRATIVE

The study of literary space has undergone a transformation from aesthetic discussion to vectorized analysis. Early studies regarded spatial imagery as literary symbols, and the analytical methods remained at the level of textual interpretation [6,7]. After entering the digital humanities stage, research tended to explore the patterns of spatial narrative through quantitative methods. Some scholars used text mining, word frequency statistics, and location entity recognition technologies to extract geographical information from works, realizing the temporal-spatial computational analysis of plot migration. Regional literary studies began to combine with geographic information visualization, reconstructing the action paths of characters in novels in a graphical way.

Existing research focuses on urban narratives, immigrant literature, and ethnic minority literature, but a proper path has not yet been found for its application in teaching Chinese language literature. There is a lack of mature teaching experiment designs and operational spatial narrative teaching models, making it difficult for teachers to translate classroom experiments into actual teaching. The complex characteristics of spatial imagery and multilayered geographical symbolism in literary works cannot be presented in teaching, and students lack an understanding of literary space. Therefore, how to construct a spatial narrative teaching model using technological means is a prerequisite for the continued development of this research.

C. APPLICATIONS OF GIS IN EDUCATION

GIS is widely used in education for spatial data acquisition, analysis, and visualization. It not only has educational significance but is also widely applied in fields such as history, language, and art. GIS supports multidimensional data integration by converting place names, movement trajectories, and geographical features in literary texts into vectorized spatial data and visualizing literary narratives through spatial overlay analysis. In international educational research, GIS is used for constructing textual geographic maps, simulating spatial conflicts, and analyzing cultural diffusion paths, forming a geographic data-driven humanities teaching model [8,9]. Domestic applications mainly focus on regional cultural display and geographical inquiry teaching, with little involvement in spatial visualization practices in the literary field. This study uses ArcGIS and QGIS platforms in a teaching experiment to annotate and

integrate geographical symbols in literary texts, displaying the flow of plot in the form of narrative maps and spatial network diagrams. This verifies students' cognitive improvement in spatial identification, narrative reconstruction, and cultural understanding, thereby realizing the spatialization of literary classroom teaching.

III. RESEARCH METHODS

A. SELECTION OF RESEARCH SUBJECTS

The study takes regional literary works teaching as a sample and selects texts with clear geographical identity and spatial narrative characteristics. The core research objects are selected as Border Town and Ordinary World. The two works differ significantly in their geographical settings: one is based on the ecological culture of western Hunan mountains, while the other reflects the social structure of the Loess Plateau in northern Shaanxi. They have typical regional symbols and cultural spatial tension [10]. The research objects cover three levels: literary texts, student groups, and the teaching environment. The subjects of the experiment are two parallel classes of the third year of Chinese language and literature major of a normal university. There are 46 students in the experimental class and 45 students in the control class. The students' reading ability is compatible with the available teaching resources. The selection of works considers the spatial distribution density of narrative paths, the number of cultural and geographical elements, and the mapping potential index [11,12]. This study was approved by the Ethics Committee of Yanbian University, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form. Through GIS keyword comparison and place name recognition statistics, the geographical entity recognition rate of Border Town is 92.3% and that of Ordinary World is 88.7%, which indicates that the texts can be modeled with high precision. Table 1 shows the information of the research sample text and the experimental objects.

TABLE 1. Research Sample Texts and Experimental Subject Information

Text Name	Geographical features	Number of place names	Number of participating students	Mappable ratio
Border Town	The mountainous river system structure is obvious	84	46	92.3%
Ordinary World	Densely distributed settlements on the plateau	77	45	88.7%
Experimental site	Department of Literature, Normal University	—	—	—
Number of teachers	Teachers with a background in Geographic Information Science	—	2	—
Teaching cycle	Six weeks	—	—	—

Table 1 presents the geographic analyzability of the selected texts, together with the size and characteristics of the teaching sample.

The role of GIS tools in teaching is reflected in two main aspects: first, they help students understand the implicit geographical logic and narratives path in the text through spatial visualization, such as character migration, regional symbolism and social spatial structure; second, through operations such as layer overlay and route analysis, they transform abstract literary space into a structured cognitive model, thereby improving students' interdisciplinary analytical ability and text construction awareness.

B. DATA ACQUISITION AND PROCESSING

The data comprises two categories: literary text geographic semantic data and teaching behavior data. Text data underwent place name recognition, semantic annotation, and geographic coordinate matching using Natural Language Processing (NLP) technology. Geographic entities in the text were extracted using the spaCy and GeoText libraries in Python, and their coordinates were aligned with the National Geographic Database (CNGB). The spatial data format was standardized as GeoJSON for subsequent import into the GIS platform. Teaching behavior data was derived from students' online learning records, questionnaire feedback, and classroom corpus analysis. Data processing employed a multi-source fusion method, mapping the text geographic feature matrix and the teaching interaction matrix to the same coordinate system. Standardization was used to remove noisy data and duplicate matches. Table 2 shows the parameters for text geographic semantic extraction and processing.

TABLE 2. Parameters for Text Geographic Semantic Extraction and Processing

Data types	Processing tools	Output format	Average recognition accuracy	Data usage
Literary texts	spaCy + GeoText	GeoJSON	90.5%	Geographic mapping
Coordinate matching	CNGB Database	CSV	95.7%	Spatial alignment
Classroom Interaction Corpus	ELAN Labeling System	txt	87.9%	Behavioral Analysis
Learning Log	Moodle API	XLSX	93.2%	Participation statistics
Questionnaire Feedback	LimeSurvey platform	CSV	—	Subjective evaluation

This table explains the data collection channels and standardized format methods. To ensure the reproducibility of subsequent visualization modeling and statistical analysis, all data were manually reviewed for accuracy, with the overall error rate controlled within 5%.

C. INSTRUCTIONAL DESIGN AND EXPERIMENTAL STEPS

The teaching experiment is based on a three-dimensional structure integrating literary text, geographic space, and cultural cognition, using GIS maps and interactive systems to reconstruct the spatial nature of literary narratives. The experiment consists of six rounds, each lasting one week. The class is divided into three units: textual spatial recognition, narrative path reconstruction, and cultural semantic analysis.

(1) The text spatial recognition unit involves teachers guiding students to locate the locations of plot events on a GIS platform and generate a spatial node map.

(2) The narrative path reconstruction unit requires students to draw the characters' movement trajectories according to the sequence of events, and the system automatically generates a spatial dynamic map.

(3) The cultural semantic analysis unit combines geographical environment and plot changes to analyze the relationship between cultural symbols and social psychology.

The experimental class used interactive GIS resources for exploration learning, whereas the control class adopted a conventional text-based teaching model to ensure consistency in the teaching theme. During the experiment, a tool termed the "spatial narrative log" was introduced to record students' task completion rates in three areas—map manipulation, text annotation, and geographic interpretation—in order to monitor the spatial progression of their learning behavior. After the GIS results were exported, the system parameterized the semantic intensity of the narrative events and corresponding geographic locations.

D. DATA COLLECTION AND ANALYSIS METHODS

Data collection was divided into two main categories: quantitative and qualitative. Quantitative data included student comprehension tests, spatial cognition scales, and interaction logs; qualitative data included student self-reported texts and classroom observation records. The comprehension test consisted of 15 questions covering three dimensions: textual narrative logic, geospatial recognition, and cultural symbol cognition. Postexperiment data were analyzed using SPSS 26.0 with independent-samples t-tests to examine differences between the experimental and control classes. Spatial interaction data were analyzed using geographically weighted regression in QGIS to reveal the spatial correlation between the frequency of geo-operations and improved text comprehension. Semantic analysis was performed using NVivo 12, employing node coding to statistically analyze the frequency of spatial metaphorical words described by students. To reduce background variables, standardized data on each individual's learning time were used.

IV. RESULTS AND ANALYSIS

A. EXPERIMENTAL DATA PRESENTATION

The experimental data came from three quantitative indicators during the teaching period: text comprehension ability, spatial perception ability, and cultural cognition ability. Significant differences between the pre-test and post-test were examined ($P < 0.01$). After six weeks of GIS-assisted teaching, students in the experimental class showed improvement in all three abilities, with the greatest improvement in spatial perception ability. The control class, which followed traditional teaching methods, showed smaller gains. Detailed results are presented in Table 3.

TABLE 3. Comparison of results between the experimental group and the control group

Indicator Categories	Pre-test mean of experimental class	Post-test mean of experimental class	Post-test mean of the control group	Improvement rate (experimental class)
Text comprehension ability	69.4	85.6	74.2	+23.5%
Spatial perception ability	59.3	77.8	62.4	+31.2%
Cultural awareness	62.7	80.7	68.3	+28.7%
Spatial positioning accuracy	66.2	85.0	70.1	+28.5%
Learning satisfaction index	72.8	88.4	76.7	+21.5%

Text comprehension, spatial perception, and cultural cognition in the experimental class increased by 23.5%, 31.2%, and 28.7%, respectively. After the introduction of spatial concepts, students' understanding of narrative geography and cultural awareness expression abilities both increased continuously, and the increase in spatial positioning accuracy was positively correlated ($r = 0.82$), indicating that visualized narrative maps can strengthen the spatial logic modeling of literary events. The increase in cultural cognition was mainly reflected in a 17 percentage point increase in the correct interpretation rate of regional cultural semantic vocabulary.

B. INTERPRETATION OF RESULTS

Experimental results show that geospatial narrative teaching can enhance students' spatial sensitivity in literary analysis. GIS-assisted plot trajectory reconstruction enables students to participate in text learning through map-based cognition; the transitions between plot nodes create a memory reinforcement effect. When analyzing geographical imagery and character relationships, students do not need to rely on teacher interpretation; they can use geographical evidence to reconstruct the narrative independently, demonstrating a connection between cultural cognition and spatial perception. Narrative maps allow students to link local landscapes with social structures and understand the regional values in the work. Spatial learning methods change students' ways of thinking about texts; enhanced spatial visualization models improve students' literary comprehension, and the ability to combine humanistic narrative with scientific mapping is validated.

C. INNOVATION AND CONTRIBUTION

This study constructs a geospatial narrative-based teaching model for Chinese language and literature, achieving semantic visualization of literary texts and geographic data. It utilizes GIS to spatially map narrative plots, providing a quantifiable representation o text structure. Teaching experiments validated the model's effectiveness in enhancing comprehension and spatial cognition, demonstrating that Chinese language and literature teaching can be data-driven. The method transforms abstract narrative information from the humanities into computable structural units within a geographic information system, making literary analysis repeatable and comparable. The model's benefits lie in controllable teaching and cognitive tracking: it allows for recording students' spatial interactions, assessing learning

depth and focus, and enabling quantitative teaching research. In the context of educational informatization, the proposed spatial narrative integration path can be expanded to include local literature research, visual teaching of cultural heritage, and digital analysis of regional narrative structures, thereby establishing a data-driven research approach for Chinese language and literature teaching.

V. CONCLUSION

The experiment validated the application of geospatial narrative in Chinese language and literature, demonstrating that applying GIS technology to analyze the spatial distribution of regional heritage and literary narratives enhances students' text comprehension, spatial perception, and cultural awareness. By mapping the historical evolution of fabric craftsmanship alongside textual plots, this approach deepens the understanding of how local identities shape the cultural landscape of literary works. The experiment showed that through geographic mapping and plot path reconstruction, students can better understand the structural and regional semantic relationships of a work, transforming learning from one-way reception to spatial exploration, and achieving a two-way conversion between knowledge content and cognitive methods. Regional culture, the spatial motivations of characters' actions, and the textual geographic semantics, which are difficult to demonstrate in traditional classrooms, were reconstructed into dynamic maps using GIS. Students' expanded thinking and narrative logic judgment were quantitatively verified. The proposed model is transferable, computationally tractable, and supports feedback-driven instructional evaluation, thereby opening new avenues for digital research in literature teaching.

The limitations include the compatibility of the sample size with the system model; the experimental sample consisted of only 91 students, and although the two selected literary works were representative, their regional scope was limited, making it difficult to generalize spatial narrative teaching patterns across different literary genres. The GIS system's geographic labeling of texts still requires manual review, and its automatic accuracy is limited by place name ambiguity and semantic vagueness. The spatial semantic matching algorithm needs further optimization. The teaching primarily focuses on the quantitative verification of cognitive improvement, neglecting to incorporate cultural and emotional resonance and artistic aesthetic experience into the evaluation system. Future research could utilize diverse regional samples and multicorpus data, combining natural language processing with deep learning to align literary semantics with geographic information regarding cultural landscapes. This approach explores the pedagogical value in crosscultural literary education and the dissemination of local heritage, establishing a more universally applicable educational and academic model.

AUTHOR CONTRIBUTIONS

Ziyi Ma designed, collected and analyzed the data, and drafted the manuscript. Ziyi Ma conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Ziyi Ma participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Ethics Committee of Yanbian University, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

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