Exploration of Ideological and Political Education Reform in the Principles of Geographic Information Systems Course

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Abstract

Ideological and political education is instrumental in shaping students' humanistic, political, and professional competencies, while also serving as a critical mechanism for cultivating innovative spirit and practical abilities. Principles of Geographic Information Systems constitutes a core curriculum for geographic information science and related disciplines. This study explores reform initiatives across three dimensions—pedagogical methodologies, content integration, and assessment frameworks for ideological and political education—tailored to the distinctive characteristics of the Principles of Geographic Information Systems course, aiming to better fulfill higher education objectives and cultivate high-caliber geographic information professionals for national and societal development.

Full Text

Exploration of Ideological and Political Reform in the Principles of Geographic Information Systems Course

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Abstract

Ideological and political education is not only crucial for shaping students' humanistic, political, and professional literacy, but also serves as the key to cultivating their innovative spirit and practical abilities. The Principles of Geographic Information Systems (GIS) is a core course for geographic information science and related majors. This paper explores reforms in the ideological and

political dimensions of this course from three perspectives: teaching methodologies, teaching content, and assessment and evaluation. These reforms aim to better achieve the educational objectives of higher education institutions and cultivate more high-caliber GIS professionals for the nation and society.

Keywords: Principles of Geographic Information Systems; curriculum ideology and politics; teaching methods; teaching content

1 The Necessity of Ideological and Political Education in GIS Principles

The Principles of Geographic Information Systems is a core course for geographic information science and related majors, characterized by strong theoretical and practical components as a comprehensive discipline [**?**]. Its instruction must extend beyond technical theories and methods to encompass the cultivation of students' higher-order thinking abilities, humanistic literacy, political literacy, and professional qualities. The teaching process inherently contains rich ideological and political elements. First, GIS applications involve resource and environmental protection, socio-economic development, urban planning, and management. Students must possess correct values and social responsibility to better serve society in their future careers. Second, as a theoretically and practically comprehensive course, GIS principles require students to develop innovative spirit, practical abilities, interdisciplinary thinking, and teamwork—qualities that necessitate guidance through ideological and political education. Finally, GIS involves vast amounts of data and information, requiring students to maintain rigorous thinking, sound judgment, and awareness of data confidentiality, all of which benefit from ideological and political support [**?**].

Based on these considerations, this paper proposes a teaching reform of the GIS Principles course guided by the concept of curriculum-based ideological and political education. The reform focuses on teaching methods, content, and assessment to ensure the cultivation of high-quality GIS professionals.

2 Overall Objectives of Curriculum Ideology and Politics

This reform aims to excavate ideological elements embedded within the GIS Principles curriculum and integrate them throughout the teaching process. The overall objectives encompass four dimensions: humanistic literacy, political literacy, professional literacy, and higher-order thinking (Figure 1 [Figure 1: see original paper]).

3 Reform of Teaching Methods

The course employs flexible and diverse teaching methods as detailed below:

3.1 Problem-Based Learning

This approach emphasizes active student participation through questioning and problem-solving to explore the essence and applications of geographic information, thereby promoting intellectual development and knowledge mastery. Before the course begins, instructors communicate with students to understand their interests, needs, prior knowledge of GIS principles, and learning difficulties. This enables the design of appropriate course content tailored to students' actual situations.

3.2 Case-Based Teaching

This method guides students to analyze and discuss existing cases, cultivating critical thinking skills. Students evaluate which aspects of cases merit emulation, identify shortcomings, and propose improvements or alternative solutions. Following case analysis, instructors guide students to summarize lessons learned, develop independent thinking, and apply these insights to practice, thereby enhancing practical abilities and comprehensive qualities.

3.3 Discussion-Based Teaching

This approach encourages active classroom discussion, exchange, and question responses. Through organized group discussions and individual presentations, students share perspectives and experiences, learn from one another, and promote intellectual development and knowledge acquisition while improving autonomous learning and problem-solving capabilities.

3.4 Experiential Learning

Students engage in hands-on operations including raster data analysis, vector data analysis, network analysis, terrain analysis, and spatial statistical analysis to better understand and master GIS principles. For instance, experiential learning integrates theoretical knowledge with software such as ArcGIS, SuperMap, and QGIS, enabling students to complete practical tasks independently and thereby enhance their practical competencies.

3.5 Project-Based Learning

Projects guide students in conducting spatial analysis, helping them understand theoretical and methodological applications across industries while improving humanistic and political literacy. For example, participating in the creation of China' s administrative division map cultivates territorial consciousness and rigorous scientific work attitudes, particularly regarding the South China Sea, where "every dot must be accurate."

3.6 Blended Online-Offline Teaching

Utilizing platforms like Xuexitong and Rain Classroom, this approach combines online and offline instruction. Before class, instructors release learning resources online for preview, improving offline teaching efficiency and fostering autonomous learning. During class, online sign-in complements offline questioning, discussion, presentations, and defense, developing clear expression and scientific reasoning abilities. After class, online platforms facilitate discussion and exchange between teachers and students.

3.7 Blended Campus-Industry Learning

This method organizes student visits to relevant enterprises and institutions to learn about cutting-edge GIS technologies and methods while cultivating craftsmanship, responsibility, standardization, and teamwork awareness. Additionally, inviting renowned experts from domestic and international universities and companies such as Esri China and SuperMap to deliver lectures keeps students informed about theoretical and technological frontiers, broadens their perspectives, and nurtures innovative thinking.

4 Reform of Teaching Content

The teaching content is reorganized along the pathway of "hardware/software—acquisition—management—processing—analysis—modeling—display."Ideological elements are excavated and integrated into the curriculum to form a comprehensive teaching system closely linked with ideological and political education (Table 1).

Table 1 Ideological and Political Elements in GIS Principles Course

GIS Teaching Content	Ideological and Political Elements
Hardware/Software1. Digitizers, plotters2. GIS professional software, databases3. Operating system software	1. Awareness of national geographic information security2. Territorial consciousness3. Confidentiality awareness
Data Acquisition1. Geographic coordinate systems2. Projected coordinate systems3. Surveying and mapping data4. Satellite data	1. Rule of law awareness2. Teamwork awareness3. Cultural confidence and national pride4. Diligence and rigorous work ethic
Data Management1. Spatial databases2. Vector data3. Raster data	1. Scientific thinking2. Scientific exploration spirit and dedication to serving the nation through technology3. Ability to rationally analyze and grasp essential issues

GIS Teaching Content	Ideological and Political Elements
Data Processing1. Data transformation2. Data reconstruction3. Data extraction	1. Environmental protection awareness2. Cultivation of social responsibility
Spatial Analysis1. Spatial query and measurement2. Overlay analysis3. Buffer analysis4. Network analysis5. Terrain analysis	1. Cultivation of autonomous learning, innovation, and professional mission2. Development of patriotism and national strategic identification3. Enhancement of professional identity and mission
Modeling1. Land use suitability models2. Site selection models3. Flood prediction models4. Population diffusion models5. Soil erosion models	1. Development of domestic computer hardware2. Development of domestic GIS software3. Development of China' s GIS industry
Visualization1. Thematic map production2. Campus 3D modeling3. Tongling City 3D modeling4. Map compilation standards	1. *Basic Geographic Information Element Classification and Coding*2. *Surveying and Mapping Law*3. Development of domestic surveying instruments4. Development of domestic satellites
Case Studies1. Current status of domestic database software2. Raster resolution determination methods3. Raster code determination methods	1. Haze and satellite image radiometric correction2. Distribution of impoverished villages and poverty alleviation
Practical Applications1. Tongling specialty white ginger planting area analysis2. Anhui water-land transportation and economic development3. Revolutionary warfare and the Dabie Mountains region	1. Scientific thinking for problem analysis and solving2. Autonomous learning and exploration abilities
Social Context1. Economic development and population migration across Anhui cities2. Chaohu Lake ecological environmental protection3. Distribution of grain crop planting areas in Anhui	1. Map production standards2. Enterprise visits3. Industry lectures

5 Reform of Assessment and Evaluation

The traditional "usual grades + final exam"model is abandoned. The assessment for GIS Principles includes the following components:

5.1 Evaluation of Humanistic and Political Literacy

Through instructor evaluation, self-assessment, and peer assessment, students are comprehensively evaluated across ten dimensions: ideological quality, moral concepts, physical and mental well-being, personality cultivation, ideals and beliefs, patriotism, cultural confidence, political identification, rule of law spirit, and social responsibility. Ratings follow four levels: excellent, good, moderate, and poor (Table 2), with weightings of 40% for instructor evaluation, 30% for self-assessment, and 30% for peer assessment.

Table 2 Evaluation of Humanistic and Political Literacy

Dimension	Excellent (10 pts)	Good (7 pts)	Moderate (5 pts)	Poor (3 pts)
Ideological Quality	Tolerant and self-disciplined with firm will; steadfast Marxist belief; ability to dialectically analyze problems; high ideological consciousness; adherence to correct values	Self-disciplined with relatively firm will; acceptance of Marxist principles; correct ideological stance and values	Weak self-discipline; unstable mental state; values susceptible to negative influences; distorted values	Narrow-minded; lacking self-discipline and willpower; no understanding of Marxism; easily influenced by unhealthy thoughts
Moral Concepts	Strict observance of social and professional ethics; consistent words and actions; strong sense of social responsibility; exemplary role model	Adherence to basic moral norms; trustworthy and helpful behavior; demonstration of fundamental ethical standards	Shallow understanding of moral norms; occasional inconsistency between words and actions; weak sense of social responsibility	Lack of basic moral concepts; inconsistency between words and actions; selfishness; violation of basic moral principles

Dimension	Excellent (10 pts)	Good (7 pts)	Moderate (5 pts)	Poor (3 pts)
Physical & Mental Well-being	Strong and healthy; good lifestyle habits; psychologically stable; strong stress resilience; good interpersonal relationships	Good physical condition; healthy lifestyle habits; relatively stable psychology; some stress resilience	Average physical condition; some unhealthy habits; psychologically vulnerable; weak stress resilience	Poor physical condition; unhealthy lifestyle; negative psychological state; extremely poor stress resilience
Personality Cultivation	Noble character; modest and prudent; continuous self-improvement	Good personality cultivation; ability to be modest and tolerant; proactive self-enhancement	Average personality cultivation; insufficient humility and tolerance; lack of initiative for improvement	Poor personality cultivation; arrogant and narrow-minded; indulgent behavior
Ideals & Beliefs	Firm belief in communism and socialism with Chinese characteristics; clear goals; unwavering will	Identification with ideals and beliefs; relatively clear goals; firm will generally maintained	Understanding of ideals but unclear goals; wavering when facing difficulties	No understanding of ideals; no clear goals; weak will; easily giving up pursuits
Patriotism	Strong patriotic spirit; concern for national affairs; active participation in national development; willingness to contribute	Relatively strong patriotic spirit; concern for national development; participation in construction within capacity	Average patriotic spirit; insufficient concern for national affairs; low participation enthusiasm	Lack of patriotic spirit; no concern for national affairs; self-centered

Dimension	Excellent (10 pts)	Good (7 pts)	Moderate (5 pts)	Poor (3 pts)
Cultural Confidence	Deep understanding of Chinese cultural values; full of confidence; active inheritance and promotion	Understanding of main Chinese cultural content; some confidence; active inheritance and promotion	Shallow understanding of Chinese culture; insufficient confidence; weak intention to promote	No understanding of Chinese culture; no confidence; rejection or even opposition
Political Identification	Firm support for Party leadership; understanding of system superiority; compliance with policies; active political participation	Support for Party leadership and system superiority; policy compliance; relatively active political participation	General identification with Party leadership and system; shallow policy understanding; low political participation	Opposition to Party leadership; non-compliance with policies; no political participation
Rule of Law Spirit	Strong legal consciousness; familiarity with laws and regulations; strict compliance; respect for legal authority; good at using law to protect rights	Strong legal consciousness; understanding of basic laws; compliance; respect for legal authority; ability to protect rights	Average legal consciousness; incomplete legal knowledge; occasional violations; shallow respect for law	Lack of legal consciousness; ignorance of laws; frequent violations; disrespect for legal authority

Dimension	Excellent (10 pts)	Good (7 pts)	Moderate (5 pts)	Poor (3 pts)
Social Responsibility	Proactive assumption of social responsibility; concern for public welfare; courage to face social issues; positive contribution	Ability to bear some social responsibility; concern for public welfare; some attention to social issues	Weak sense of social responsibility; insufficient concern for public welfare; shallow understanding of social issues	Lack of social responsibility; no concern for public welfare; self-interest only

5.2 Evaluation of Professional Literacy

A final closed-book exam assesses mastery of GIS principles and theoretical knowledge. Practical operation evaluations examine software proficiency and report standardization, testing professional skills, competence, work style, and professional spirit.

5.3 Evaluation of Higher-Order Thinking

Classroom discussions, exchanges, group collaboration, and individual presentations assess student engagement and communication abilities, including discussion participation, analytical depth, solution rationality, task completion, and seminar involvement. These evaluate decision-making and critical thinking skills. Open-ended project tasks based on the latest national and industry developments test students' ability to apply GIS knowledge to real-world problems, assessing scientific thinking, innovative spirit, independent thinking, and expression capabilities.

The final course grade is a weighted average across four dimensions: humanistic literacy, political literacy, professional literacy, and higher-order thinking. Humanistic and political literacy account for 40%, professional literacy for 40%, and higher-order thinking for 20%.

6 Conclusion

Ideological and political education in the GIS Principles course constitutes a vital component of undergraduate education. Through this course, students develop across multiple dimensions including humanistic literacy, political literacy, professional literacy, and higher-order thinking. Continuous reform, exploration, and practical improvement of teaching methods, content, and assessment will better achieve educational goals and cultivate more high-quality GIS professionals for national and social development.

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Note: Figure translations are in progress. See original paper for figures.