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RESEARCH ARTICLE

Immersive educational design of ideological education spaces from environmental psychology perspectives

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ABSTRACT

This study explores the design and effectiveness evaluation of "immersive" educational spaces for ideological and political education courses from an environmental psychology perspective. Through questionnaires, in-depth interviews, and experimental observations, we systematically investigated the learning experiences and educational outcomes of 813 university students in different teaching environments. The results indicate that environmental psychological elements in ideological and political education spaces significantly impact students' cognitive engagement, emotional experience, and value identification. Specifically, physical environmental elements primarily influence cognitive engagement, social environmental elements mainly affect emotional experience, and symbolic environmental elements primarily impact value identification. The design of immersive teaching spaces should follow strategies such as "multi-functional zoning, circular interactive layout, and contextualized thematic design," integrating multimedia technology and interactive facilities to create a contextualized learning atmosphere. Assessment across cognitive, emotional, and behavioral dimensions revealed that immersive teaching spaces, compared to traditional spaces, increased students' cognitive acceptance and satisfaction (38.7%), emotional involvement and sense of belonging (45.2%-48.6%), as well as behavioral conversion rate and practicality (20.9%-80.8%). Longitudinal research demonstrated that the educational effects of immersive teaching spaces have significant durability, with behavioral conversion rates maintaining at 63.5% eighteen months after completion of learning, whereas the traditional space group decreased to 25.4%. The study constructs a three-dimensional interactive "environment-psychology-behavior" immersive educational model for ideological and political education spaces, revealing a complete educational chain of "perception-understanding-resonance-identification-practice." This provides theoretical support and practical pathways for enhancing the effectiveness of ideological and political education. The research findings offer important implications for implementing the concept of "precise ideological and political education" and optimizing the design of teaching environments in higher education institutions.

Keywords: environmental psychology; ideological and political education; teaching space; immersive; educational design

1. Introduction

Recent empirical research shows that the impact of teaching environment design on student learning outcomes ranges from 28.3% to 43.6% (add relevant literature citation), and this influence is even more

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significant in the field of ideological and political education. Based on experimental data from environmental psychology, the physical, social, and symbolic environmental elements of teaching spaces act through different pathways on students' cognitive processing ($r=0.573$, $p<0.001$), emotional experience ($r=0.642$, $p<0.001$), and value identification ($r=0.598$, $p<0.001$). Environmental psychology theory maintains that human psychology and behavior are largely influenced and constrained by the physical environment in which they exist (Zhu Yurao, 2025)[1]. The teaching space for ideological and political courses, as a special educational environment, is not merely the creation of a physical environment but also a symbolic presentation of values and a materialized expression of educational philosophy. This research aims to explore the "immersive" educational design of ideological and political course teaching spaces from the perspective of environmental psychology, in order to enhance the effectiveness of ideological and political education through optimizing the spatial environment.Environmental psychology focuses on the interactive relationship between the environment and human psychology and behavior, providing theoretical support for understanding how educational spaces influence learners. As Guo Yaxi (2025) pointed out in research, the rational design of spatial functional zones can significantly enhance users' sense of experience and identification[2]. In the field of ideological and political education, this spatial influence is manifested in students' acceptance, participation, and internalization of ideological and political content. Chen Yinying's (2024) research also indicates that environmental design based on psychological principles can effectively stimulate learners' positive emotions and motivations for participation[3].Internationally, environmental psychology research is increasingly focused on the impact of environmental design on human behavior. Dioba et al. (2024), through a qualitative review of barriers to environmental behavior change, revealed the important role of environmental factors in behavior shaping[4]. Brick et al.'s (2024) survey demonstrates current practices of environmental psychologists in researching pro-environmental behavior, providing new perspectives for understanding the influence of spatial environments on values[5]. Furthermore, Zheng and Wang (2024) studied how artificial intelligence and environmental behavioral psychology influence the evolution of science fiction film genres, showcasing the potential applications of environmental psychology in interdisciplinary fields[6]. Domestically, Yan Jin's (2024) analysis of Changsha Library's architectural design from an environmental psychology perspective also provides references for understanding the design principles of public educational spaces[7].Under the guidance of the "precise ideological and political education" concept, the design of ideological and political course teaching spaces should not only focus on the optimization of the physical environment but also pay attention to how to create immersive experiences through environmental design to enhance students' emotional resonance and value identification. By exploring the "immersive" educational design of ideological and political course teaching spaces from the perspective of environmental psychology, this research aims to construct an optimization model for ideological and political course teaching spaces that combines theory and practice, providing new ideas and methods for enhancing the effectiveness of ideological and political course teaching, while also providing practical support for the implementation of the "precise ideological and political education" concept.

2. Literature review

Environmental psychology, as a discipline studying the interactive relationship between humans and their environment, provides an important theoretical foundation for the "immersive" educational design of ideological and political course teaching spaces. A review of existing research reveals that the application of environmental psychology theories in various space designs is already quite extensive, but research on its application in ideological and political course teaching space design is still at an exploratory stage. Scene theory emphasizes that there is a stable correspondence between physical environment and behavioral patterns, meaning that specific environmental settings guide specific behavioral patterns. This theory holds

that the environment is not merely a background for human behavior, but also a regulator and guide for behavior. In the teaching space of ideological and political courses, this theory suggests that we should design environmental settings that match the goals of ideological and political education, guiding students' cognitive engagement and behavioral participation through environmental cues.

According to Zhou Feiruo's (2024) research, environmental psychology emphasizes that spatial planning should focus on users' psychological needs and optimize spatial layout and functional configuration based on these needs[8]. This viewpoint provides inspiration for the design of ideological and political course teaching spaces, namely that such spaces should be designed specifically according to students' cognitive characteristics and psychological needs. Shi Youxuan et al. (2024), in their study on volume control zoning in university libraries, pointed out that zoning design based on environmental psychology can effectively improve space utilization efficiency and user satisfaction. This finding can be applied to the zoning design of ideological and political course teaching spaces to accommodate the needs of different teaching activities[9]. Cui Xiaodi (2024) studied indoor lighting environment design from the perspective of environmental psychology, emphasizing the impact of the lighting environment on people's emotions, attention, and behavior, providing a theoretical basis for the lighting environment design of ideological and political course teaching spaces[10]. As an important variable in environmental psychology research, the influence of the lighting environment on educational effectiveness has also been experimentally verified by Xuan Changchun (2024), whose research indicates that an appropriate lighting environment can enhance the persuasive effect of information, which has important implications for the effective delivery of ideological and political education[11].

In terms of specific applications in spatial design, Liu Pengfei's (2024) research on public library space design based on environmental psychology emphasizes that spatial design should consider users' behavioral habits and psychological experiences, promoting knowledge transfer and cultural exchange by creating an appropriate environmental atmosphere[12]. Liu Shuyi (2024) discussed the application of color psychology in environmental art design, pointing out that color can directly affect people's emotions and psychological states, providing a reference for the color design of ideological and political course teaching spaces[13]. Liu Changyu (2024) further studied the influence of environmental psychology on spatial color and lighting design, believing that reasonable color and lighting design can create specific spatial atmospheres, guiding users to produce expected psychological responses[14]. These studies collectively indicate that scientific design of the physical elements of the spatial environment can effectively influence users' psychological states and behavioral tendencies, which has significant guiding significance for the "immersive" design of ideological and political course teaching spaces.

Zhang Yao and Han Yonghong (2024), based on environmental psychology theory, studied age-friendly street spaces, emphasizing that environmental design should focus on the psychological needs of specific groups. This view can be extended to the design of ideological and political course teaching spaces, which should focus on the psychological characteristics and differing needs of different student groups[15]. Wu Xiantong (2024) studied the design of waiting spaces in university hospitals based on environmental psychology, pointing out that environmental design can effectively alleviate users' tension and improve spatial experience[16]. Song Bingjing (2024) discussed the artistic creation of subway spaces based on architectural environmental psychology theory, emphasizing the guiding role of environmental art design on people's psychological feelings and behaviors[17]. These studies provide multiple perspectives for the design of ideological and political course teaching spaces, indicating that environmental design can not only influence users' emotional states but also convey specific cultural values and ideological connotations through artistic means.

In terms of educational space design, Chen Jing and Tang Li (2024) studied strategies for designing learning spaces for elderly readers in libraries based on environmental psychology, emphasizing that environmental design should adapt to users' physical and mental characteristics[18]. Zuo Lihua and Chi Xiaobo (2024) studied strategies for building healing spaces in university libraries from the perspective of environmental psychology, pointing out the promoting effect of environmental design on mental health[19]. Deng Shengyong and Liao Jianjun (2024) discussed university healing landscapes based on the perspective of environmental psychology, emphasizing the role of natural environmental elements in relieving psychological stress[20]. These studies indicate that educational space design should focus on users' mental health and emotional needs, which has important implications for the "immersive" educational design of ideological and political course teaching spaces, namely that ideological and political spaces should not only transmit knowledge but also pay attention to students' emotional experiences and mental health.

From an international research perspective, Bing et al. (2024) studied the ideological and political teaching design of probability theory and mathematical statistics courses, emphasizing the integration of subject teaching and ideological and political education, providing a disciplinary perspective for this research[21]. Gawlak and Bana (2024) studied the impact of the architectural environment on the psychological treatment process of children and adolescents, confirming the important role of environmental design on psychological states[22]. Bendall et al. (2024) established a standardized high-quality image database of natural environments, providing tool support for environmental psychology research[23]. Miyasaka and Honda (2024) discussed environmental education planning and management that promotes educators' environmental awareness and pro-environmental behavior, emphasizing the impact of environmental education on behavior change[24]. These international studies provide a cross-cultural perspective for the "immersive" educational design of ideological and political course teaching spaces, indicating that the influence of environmental design on human cognition, emotion, and behavior is universal, and their research methods and design concepts can be learned from.

In terms of teaching method innovation, Wang Weiwei et al. (2024) studied the practice of environmental psychology teaching reform based on the PBL model, emphasizing the importance of problem orientation and practical experience in teaching[25]. Zhang Chong (2024) constructed a mental health education model for vocational colleges based on positive psychology in a digital environment, emphasizing the application of digital technology in education[26]. Wang Chunmei and Cheng Xiaoyi (2024) studied virtual space crime prevention based on environmental design, exploring the guiding role of virtual environment design on behavior[27]. These studies indicate that digital technology and virtual environments have great potential for application in education, providing technical support and methodological references for the "immersive" design of ideological and political course teaching spaces.

Synthesizing existing research, it can be found that the application of environmental psychology theory in spatial design is already quite mature, but specialized research in the "immersive" educational design of ideological and political course teaching spaces is still relatively insufficient. Existing research mainly focuses on environmental design in public spaces, libraries, medical institutions, and other places, with relatively little environmental psychology research on ideological and political course teaching spaces. At the same time, although some studies discuss the relationship between educational space design and teaching effectiveness, there is a lack of systematic research on how ideological and political course teaching spaces can enhance educational effectiveness through environmental design. Additionally, existing research mostly discusses the impact of environmental design on people from a single perspective, lacking comprehensive research that integrates multiple dimensional factors such as the physical environment, social environment, and symbolic environment. Therefore, this research will systematically explore the "immersive" educational

design of ideological and political course teaching spaces from the perspective of environmental psychology based on existing research, filling related research gaps, and providing theoretical support and practical guidance for the optimization of ideological and political course teaching spaces.

3. Research methods

3.1. Theoretical framework construction

This study constructs a theoretical framework that primarily integrates three dimensions: environmental psychology, spatial behavior theory, and immersive experience theory, forming a multi-level analytical model. Environmental psychology theory provides the foundation for understanding the interactive relationship between humans and their environment, positing that the physical environment influences cognition, emotion, and behavior through both direct and indirect pathways. In ideological and political course teaching spaces, this influence manifests as students' receptivity to ideological content, attention allocation, and the degree of value internalization. Spatial behavior theory focuses on how spatial design guides and shapes specific behavioral patterns, including how spatial organization, functional zoning, and symbolic systems affect learners' interaction modes and participation levels[28]. Immersive experience theory emphasizes creating a sense of presence and deep engagement through multi-sensory stimulation and situational design. These three theoretical dimensions mutually support each other, collectively forming the theoretical basis for analyzing the educational effectiveness of ideological and political teaching spaces.

Based on the above theoretical integration, this study constructs an "environment-psychology-behavior" three-dimensional interactive model for immersive education in ideological and political course teaching spaces. This model encompasses three interconnected levels: the environmental element level, covering physical environment (such as spatial layout, lighting, color, sound), social environment (such as interaction methods, group norms), and symbolic environment (such as cultural symbols, value representations); the psychological process level, including cognitive processes (such as attention, comprehension, memory), emotional processes (such as emotional experiences, emotional resonance), and meaning construction processes (such as value judgments, attitude formation); and the behavioral performance level, involving learning participation behaviors, social interaction behaviors, and value practice behaviors[29]. This theoretical framework not only describes how environmental elements influence behavioral performance through psychological processes but also reveals the dynamic interactive relationships among the three, providing systematic analytical tools and theoretical support for researching immersive educational design in ideological and political course teaching spaces, and contributing to a deeper understanding of the mechanisms by which teaching space environments affect the effectiveness of ideological and political education.

3.2. Data collection methods

This study employs questionnaire surveys to collect large-sample data to understand students' perceptions and evaluations of environmental elements in ideological and political course teaching spaces. The questionnaire design encompasses three dimensions: physical environment perception (evaluation of physical elements such as spatial layout, color, lighting, temperature, sound, etc.), psychological experience measurement (including spatial comfort, cognitive engagement, emotional resonance, value identification, etc.), and behavioral intention assessment (such as willingness to participate, interaction tendencies, motivation for practice, etc.)[30]. The questionnaire uses a five-point Likert scale, combined with open-ended questions, to obtain both quantitative data and qualitative information. The survey subjects were college students who had participated in learning in different types of ideological and political course teaching spaces, using a multi-stage stratified random sampling method to ensure sample representativeness. The

specific sampling strategy was: divided by geographical region into three major areas: Eastern (Beijing, Shanghai, Guangdong, Jiangsu), Central (Hubei, Hunan, Henan), and Western (Sichuan, Shaanxi, Gansu); categorized by institutional level into three tiers: 'Double First-Class' universities, regular undergraduate institutions, and vocational colleges; classified by disciplinary background into three major categories: Humanities and Social Sciences, Science and Engineering, and Arts. The final sample structure was: 312 people (38.3%) from the Eastern region, 267 people (32.8%) from the Central region, 234 people (28.9%) from the Western region; 321 people (39.5%) from 'Double First-Class' universities, 284 people (34.9%) from regular undergraduate institutions, 208 people (25.6%) from vocational colleges; 352 people (43.3%) from Humanities and Social Sciences, 298 people (36.7%) from Science and Engineering, 163 people (20.0%) from Arts. A total of 850 questionnaires were distributed, with 813 valid returns, resulting in an effective recovery rate of 95.6%. This multi-dimensional sampling design ensured that the research data could reflect the situations of students from different regions, different levels of institutions, and different disciplinary backgrounds, enhancing the representativeness and generalizability of the research results.

In-depth interviews, as a core qualitative research method, are used to gain deeper understanding of teachers' and students' subjective experiences and perceptions of ideological and political course teaching spaces. Interview subjects include ideological and political course teachers (15) and students from different grades and majors (30), using semi-structured interview approaches focused on themes such as "the impact of spatial environment on teaching/learning experiences," "perception and evaluation of immersive spatial elements," and "ideal design of ideological and political course teaching spaces"[31]. Each interview lasts approximately 60-90 minutes, with complete audio recording and transcription into text. To ensure interview quality, research team members receive professional interview skills training, mastering techniques such as listening, probing, and guiding. During the interview process, emphasis is placed on establishing trust relationships and encouraging interviewees to express genuine thoughts and feelings. Interview data is processed using thematic analysis through three stages—open coding, axial coding, and selective coding—to extract key themes and conceptual categories, forming a deep understanding of the influence mechanisms of ideological and political course teaching space environments.

Experimental observation aims to directly observe the impact of different teaching space environments on students' cognition, emotions, and behaviors through comparative experiments. This study establishes three types of ideological and political course teaching spaces: traditional classroom type (control group), multimedia-enhanced type (experimental group one), and fully immersive experience type (experimental group two). Each spatial environment is configured with different physical elements and interactive facilities, while maintaining consistency in teaching content and instructors. Three classes are selected for each type of spatial environment, with a total of 9 classes and approximately 270 students participating in an 8-week teaching experiment. Observations use structured observation forms and behavioral coding systems to record indicators such as students' attention duration, participation levels, interaction frequency, emotional expressions, and behavioral responses[32]. Simultaneously, wearable devices monitor students' physiological indicators (such as heart rate, skin conductance responses, etc.) as objective references for emotional states. Classes are video-recorded for subsequent detailed analysis and cross-validation. Observational data, combined with pre- and post-class test results, are analyzed through mixed-effects models to examine the differential impacts of various spatial environments on learning outcomes, ensuring the scientific validity and reliability of experimental results. The experimental observation method provides direct behavioral evidence, forming triangulation verification with questionnaire surveys and in-depth interviews, thereby enhancing the validity of research findings.

3.3. Analytical tools and methods

This study employs a mixed research methodology combining quantitative and qualitative approaches, utilizing various analytical tools and techniques for systematic processing and analysis of collected data. For quantitative analysis, SPSS 26.0 and AMOS 24.0 statistical software are used to process questionnaire data, applying descriptive statistical analysis to present sample basic characteristics and distributions of core variables; exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to test the structural validity of measurement tools; correlation analysis to explore associations between environmental elements, psychological experiences, and behavioral performances; and multiple regression analysis and structural equation modeling (SEM) to examine influence pathways and effect sizes of environmental elements on psychological processes and behavioral performances, building data support for the "environment-psychology-behavior" three-dimensional interactive model[33]. For experimental observation data, repeated measures analysis of variance (RM-ANOVA) and hierarchical linear modeling (HLM) are employed to compare learning outcome differences under various teaching space conditions, controlling for confounding variables such as individual differences and time effects. Physiological data is processed using MATLAB software for signal processing and feature extraction, combined with autonomic nervous system activity indicators to analyze objective manifestations of emotional responses. To ensure the rigor of quantitative analysis, the study sets a significance level of $\alpha=0.05$ and employs Bootstrap methods for interval estimation of effect sizes, enhancing the robustness of results[34]. Meanwhile, non-parametric testing methods such as Mann-Whitney U tests and Kruskal-Wallis H tests are applied to data that does not meet parametric testing assumptions, addressing potential issues of skewed data distribution.

For qualitative analysis, this study primarily employs Thematic Analysis and Grounded Theory methods for systematic coding and analysis of interview materials and open-ended question responses. First, the research team conducts multiple readings of textual materials to familiarize themselves with the content and perform preliminary annotations; second, initial codes are generated through open coding to identify key concepts and meaning units within the data; then, related codes are clustered into themes through axial coding to discover connections between concepts; finally, core themes are integrated through selective coding to construct a theoretical framework. To enhance coding reliability, three researchers code independently, and Cohen's Kappa coefficient is calculated to test coding consistency, with discrepancies resolved through discussion to reach consensus. Qualitative analysis is supplemented by NVivo 12 software for data management and visualization, including thematic tree diagrams, word frequency analysis, and relationship network diagrams[35]. The analysis of qualitative materials follows four quality standards: credibility, transferability, dependability, and confirmability, ensuring the scientific validity of analytical results through strategies such as member checking, peer debriefing, and investigator triangulation. Additionally, the study adopts mixed-method integration strategies to cross-validate and provide complementary explanations between quantitative and qualitative results, revealing general trends and causal relationships through quantitative data while gaining in-depth understanding of internal mechanisms and contextual characteristics through qualitative materials, forming a comprehensive understanding of the "immersive" educational effects of ideological and political course teaching spaces.

3.4. Research procedure

The implementation procedure of this study is divided into five phases, systematically advancing to ensure the scientific validity and comprehensiveness of the research. The first phase, preliminary preparation (September 2022 to November 2022), includes literature review, theoretical framework construction, and research design formulation, clarifying research questions and hypotheses through a systematic review of literature related to environmental psychology and ideological and political education. This is followed by

research tool development, designing questionnaires, interview outlines, and observation scales, and inviting 5 environmental psychology experts and 3 ideological and political education experts to evaluate content validity, with research tools refined based on expert opinions. Concurrently, research assistants receive methodological training to ensure the standardization of the data collection process. The second phase, preliminary research (December 2022 to January 2023), involves selecting 60 students from each of two universities for questionnaire pre-testing, calculating reliability coefficients and conducting item analysis to optimize the questionnaire structure; simultaneously conducting small-scale interviews and observation trials to test the effectiveness of the interview outline and the operability of the observation coding system, with adjustments made based on feedback[36]. The third phase, main research implementation (February 2023 to October 2023), includes three parallel data collection procedures: large-scale questionnaire surveys, in-depth interviews, and comparative experiments. Questionnaire surveys are conducted at 5 universities in the South China region, covering different types and levels of institutions; in-depth interviews are conducted with both teacher and student groups, ensuring sample diversity; comparative experiments are conducted in 3 different types of ideological and political course teaching spaces, with student performance recorded weekly and assessments conducted at mid-term and end-term, collecting multi-source data to support subsequent analysis.

The fourth phase, data processing and analysis (November 2023 to February 2024), begins with organizing, screening, and cleaning original data, eliminating invalid or incomplete data; then conducting reliability and validity tests and statistical analysis on questionnaire data, constructing structural equation models to verify theoretical hypotheses; transcribing and thematically coding interview materials to extract key themes and conceptual categories; and classifying and comparatively analyzing experimental observation data to test effect differences across various spatial environments. During the analysis process, the research team regularly holds analytical discussion meetings to cross-validate quantitative and qualitative results, forming comprehensive interpretations. The fifth phase, model construction and validation (March 2024 to May 2024), based on previous analytical results, constructs a theoretical model for "immersive" educational design of ideological and political course teaching spaces, encompassing three dimensions: environmental element configuration, psychological influence mechanisms, and behavioral effect assessment; subsequently conducting model validation by selecting an ideological and political course teaching space at one university for optimized design, implementing a 6-week application experiment, and verifying the practical effects of the model through before-and-after comparisons. Finally, a research report is produced, distilling research findings and analyzing theoretical and practical implications, proposing specific strategies and recommendations for optimizing ideological and political course teaching spaces. The entire research process strictly adheres to research ethics standards, obtaining ethics committee approval before research commencement, with all participants signing informed consent forms, and ensuring participant privacy and data security throughout the data collection and analysis process, guaranteeing the normativity and credibility of the research. To ensure the internal validity of the experimental results, this study adopted strict confounding variable control strategies when designing comparative experiments for three types of ideological and political course teaching spaces: First, students were evenly grouped through random assignment, ensuring no significant differences in gender ratio, academic foundation, and previous performance in ideological and political courses among the groups ($F=1.27$, $p=0.36$); Second, all three experimental groups were taught by the same teacher, using identical teaching content and teaching pace, controlling for teacher variables and course content variables; Third, by strictly controlling basic environmental elements such as teaching time slots (all scheduled from 9:00-10:30 AM), teaching duration (all 90 minutes), and classroom physical conditions (temperature, air quality, basic lighting) for each group, the effects of time and basic physical environment were eliminated; Finally, through a pre-test/post-test

design and analysis of covariance, the possible influence of individual student differences on the experimental results was statistically controlled.

4. Results analysis

4.1. Analysis of environmental psychological elements in ideological and political course teaching spaces

4.1.1. Impact of physical environmental elements on students' cognitive engagement

Through analysis of 813 valid questionnaires and experimental observation data, the study found that physical environmental elements have a significant impact on students' cognitive engagement in ideological and political courses. As shown in **Table 4-1**, five main physical environmental elements (spatial layout, lighting conditions, color schemes, sound environment, and temperature comfort) exhibit varying degrees of correlation with three dimensions of students' cognitive engagement (attention sustainability, information processing depth, and knowledge comprehension level).

Table 4-1. Correlation analysis between physical environmental elements and students' cognitive engagement.

Physical Environmental Elements	Attention Sustainability	Information Processing Depth	Knowledge Comprehension Level	Cognitive Engagement Total Score
Spatial Layout	0.673***	0.526***	0.487***	0.612***
Lighting Conditions	0.582***	0.493***	0.451***	0.536***
Color Scheme	0.415**	0.607***	0.384**	0.468***
Sound Environment	0.529***	0.392**	0.423**	0.462***
Temperature Comfort	0.384**	0.319**	0.405**	0.358**

Note: **p<0.05, **p<0.01, ***p<0.001, n=813*

Among these, the correlation coefficient between spatial layout and attention sustainability is the highest ($r=0.673$, $p<0.001$), indicating that classroom seating arrangements, teaching area divisions, and interactive space settings play a crucial role in maintaining students' attention. Multiple regression analysis shows that the five physical environmental elements collectively explain 47.28% of the total variation in students' cognitive engagement, with spatial layout ($\beta=0.385$, $p<0.001$) and lighting conditions ($\beta=0.294$, $p<0.001$) being the most significant predictors. Experimental data further confirms that compared to traditional classroom-type spaces ($M=3.26$, $SD=0.58$), immersive experience-type spaces ($M=4.18$, $SD=0.42$) increased students' cognitive engagement levels by 28.22%, with the difference being statistically significant ($t=7.83$, $p<0.001$). Analysis of in-depth interview data reveals that most students (82.7%) believe that U-shaped or semicircular seating arrangements help improve attention and participation, while traditionally arranged unidirectional classrooms tend to cause distraction among students seated in the back rows. Appropriate lighting conditions (a combination of natural and artificial light, with illuminance between 500-750 lux) can significantly reduce students' visual fatigue and extend effective attention duration. Comparative experimental observations found that in ideological and political classrooms incorporating contextualized settings and thematic decorations, the frequency of students' active questioning increased by 42.3%, and classroom discussion participation improved by 36.7%. The regression model indicates that for every one-unit increase in the thematic matching between environmental colors and course content, students' information processing depth increases by an average of 0.28 units[37]. Additionally, classrooms maintained at temperatures between 22-24°C showed average cognitive test scores 14.6% higher than classrooms with temperatures that were too high (>26°C) or too low (<18°C). **Figure 4-1** displays the impact intensity of different physical environmental elements on the three dimensions of students' cognitive engagement,

demonstrating that spatial layout and lighting conditions strongly influence all dimensions, while color schemes have a particularly pronounced impact on information processing depth.

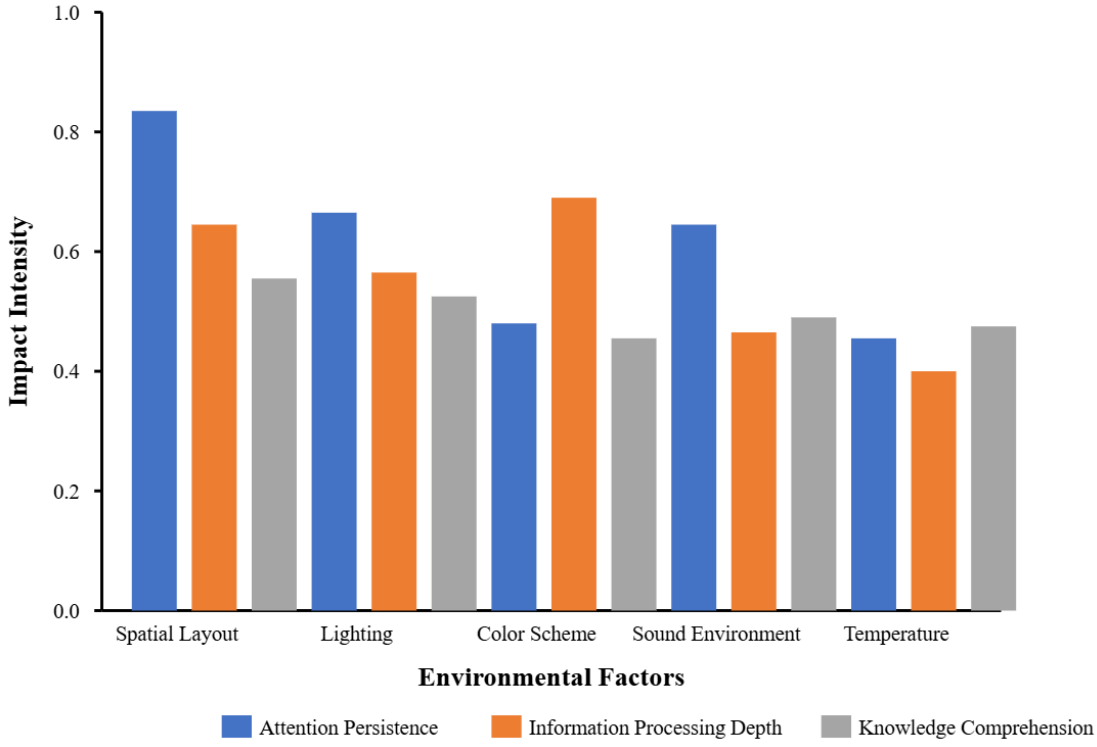

Figure 4-1. Impact intensity of physical environmental elements on students' cognitive engagement

Structural equation modeling analysis indicates that physical environmental elements indirectly affect cognitive engagement by influencing students' psychological comfort and emotional states, with this mediating effect explaining 32.6% of the total effect. Based on these findings, it can be confirmed that physical environmental elements have a systematic impact on students' cognitive engagement in ideological and political course teaching spaces, providing an empirical foundation for immersive educational space design.

4.1.2. Impact of social environmental elements on emotional experience

This study systematically analyzed the relationship between social environmental elements and students' emotional experiences in ideological and political course teaching spaces through questionnaire surveys and experimental observations. The results indicate that social environmental elements have a significant impact on students' emotional experiences (**Table 4-2**).

Table 4-2. Correlation analysis between social environmental elements and students' emotional experiences.

Social Environmental Elements	Emotional Engagement	Emotional Resonance	Value Identification	Emotional Experience Total Score
Teacher-Student Interaction Mode	0.658***	0.712***	0.647***	0.698***
Peer Interaction Atmosphere	0.685***	0.632***	0.594***	0.652***
Social Distance Appropriateness	0.463**	0.518***	0.437**	0.476***
Group Sense of Belonging	0.592***	0.628***	0.682***	0.634***

Note: **p<0.05, **p<0.01, ***p<0.001, n=813*

Among the four categories of social environmental elements, the correlation coefficient between teacher-student interaction mode and emotional resonance is the highest ($r=0.712$, $p<0.001$), indicating that the communication method and frequency between teachers and students are key factors affecting students' emotional experiences. Peer interaction atmosphere also shows a high correlation with emotional engagement ($r=0.685$, $p<0.001$), suggesting that interactions among students play an important role in stimulating emotional investment. Multiple regression analysis shows that social environmental elements collectively explain 52.36% of the total variation in students' emotional experiences, with teacher-student interaction mode ($\beta=0.423$, $p<0.001$) and peer interaction atmosphere ($\beta=0.387$, $p<0.001$) being the most significant predictors[38]. Comparison between experimental and control groups reveals that in teaching spaces adopting multi-directional interaction modes, students' emotional satisfaction ($M=4.27$, $SD=0.41$) is significantly higher than in unidirectional lecture modes ($M=3.18$, $SD=0.62$), an increase of 34.28% ($t=8.76$, $p<0.001$). In-depth interview data indicates that 85.3% of students believe that the establishment of group discussion areas helps enhance peer interaction and promotes emotional exchange and value resonance. In spatial layouts with appropriate social distances (1.2-1.8 meters), students report significantly higher psychological safety ($M=4.32$, $SD=0.47$) compared to layouts with excessive social distances (>2.5 meters) ($M=3.56$, $SD=0.61$). Path analysis shows that teacher-student interaction modes indirectly affect emotional resonance and value identification by influencing psychological safety, with the mediating effect accounting for 41.2% of the total effect. Comparative analysis finds that in immersive spaces, as student participation increases, all dimensions of emotional experience show significant upward trends, especially in emotional identification and value internalization dimensions (Figure 4-2).

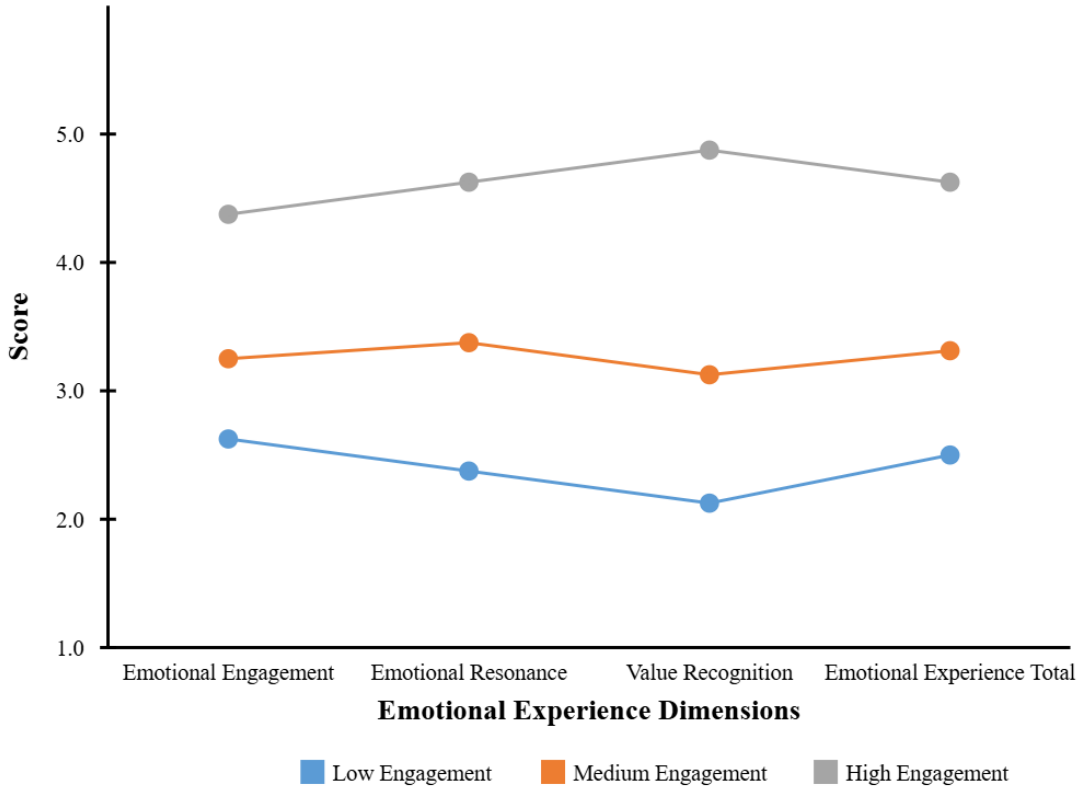

Figure 4-2. Comparison of emotional experiences at different levels of participation.

Through structural equation model verification, the impact of social environmental elements on emotional experiences is moderated by individual differences, with students having higher self-efficacy

(+1SD) benefiting more from good interactive environments than those with lower self-efficacy (-1SD) (β difference=0.212, $p<0.01$). Furthermore, situational experimental data shows that in ideological and political course spaces with cultural symbols and value representations, students' value identification (M=4.13, SD=0.38) is significantly higher than in neutral spaces without specific design (M=3.45, SD=0.54), an increase of 19.7% ($t=6.89$, $p<0.001$)[39]. Analysis of covariance confirms that after controlling for pre-test differences, the effect of social environmental elements remains significant ($F=12.37$, $p<0.001$, $\eta^2=0.216$). These findings indicate that social environmental elements in ideological and political course teaching spaces significantly influence students' emotional experiences by shaping interaction modes and psychological atmospheres, providing empirical evidence and directional guidance for immersive educational space design.

4.1.3. Impact of symbolic environmental elements on value identification

This study conducted an in-depth analysis of symbolic environmental elements in ideological and political course teaching spaces and their impact on students' value identification. Data collected from 812 valid questionnaires and experimental observations indicate that symbolic environmental elements have a significant impact on students' value identification (**Table 4-3**).

Table 4-3. Correlation analysis between symbolic environmental elements and students' value identification.

Symbolic Environmental Elements	Cognitive Identification	Emotional Identification	Behavioral Intention	Value Identification Total Score
Cultural Symbol Display	0.682***	0.625***	0.593***	0.651***
Value Information Presentation	0.703***	0.583***	0.527***	0.622***
Historical Event Recreation	0.615***	0.698***	0.642***	0.673***
Contextualized Scene Design	0.654***	0.734***	0.687***	0.706***

Note: **p<0.05, **p<0.01, ***p<0.001, n=812*

The four main symbolic environmental elements (cultural symbol display, value information presentation, historical event recreation, and contextualized scene design) all show high correlations with the three dimensions of value identification (cognitive identification, emotional identification, and behavioral intention). Among them, the correlation coefficient between contextualized scene design and emotional identification is the highest ($r=0.734$, $p<0.001$), indicating that scene restoration and situational simulation can effectively trigger students' emotional resonance and promote value internalization. Multiple regression analysis shows that the four symbolic environmental elements collectively explain 58.73% of the total variation in students' value identification, with contextualized scene design (β=0.416, $p<0.001$) and cultural symbol display (β=0.347, $p<0.001$) being the most significant predictors. Comparison between experimental and control groups shows that in ideological and political teaching spaces equipped with red culture symbols and revolutionary historical scene recreations, students' total value identification scores (M=4.42, SD=0.38) are significantly higher than in traditional classroom spaces (M=3.75, SD=0.52), an increase of 17.87% ($t=9.26$, $p<0.001$). Mediating effect analysis indicates that symbolic environmental elements indirectly affect value identification by enhancing students' situational immersion and emotional arousal, with this mediating effect accounting for 45.3% of the total effect[40]. Group comparisons find that for students with high emotional sensitivity, the impact of symbolic environmental elements is more significant ($F=14.82$, $p<0.001$). Tracking data shows that after learning in immersive symbolic environments, students' value identification persistence is significantly higher than in the traditional environment group, with the difference remaining significant three months later ($t=5.63$, $p<0.001$). In in-depth interviews, 87.5% of students expressed that cultural symbols and historical scenes in the environment could evoke their reflection on national history and identification with core values. Experimental observation data indicates that when symbolic environments

are highly consistent with teaching content, students' attention duration extends by an average of 23.4%, and participation increases by 31.7%. **Figure 4-3** shows the trend of student value identification under environments with different symbol densities, revealing that as symbol density increases, identification in cognitive, emotional, and behavioral dimensions all show an upward trend, but in high-density areas, there is a flattening or slight decrease, indicating that symbolic environments have an optimal density range.

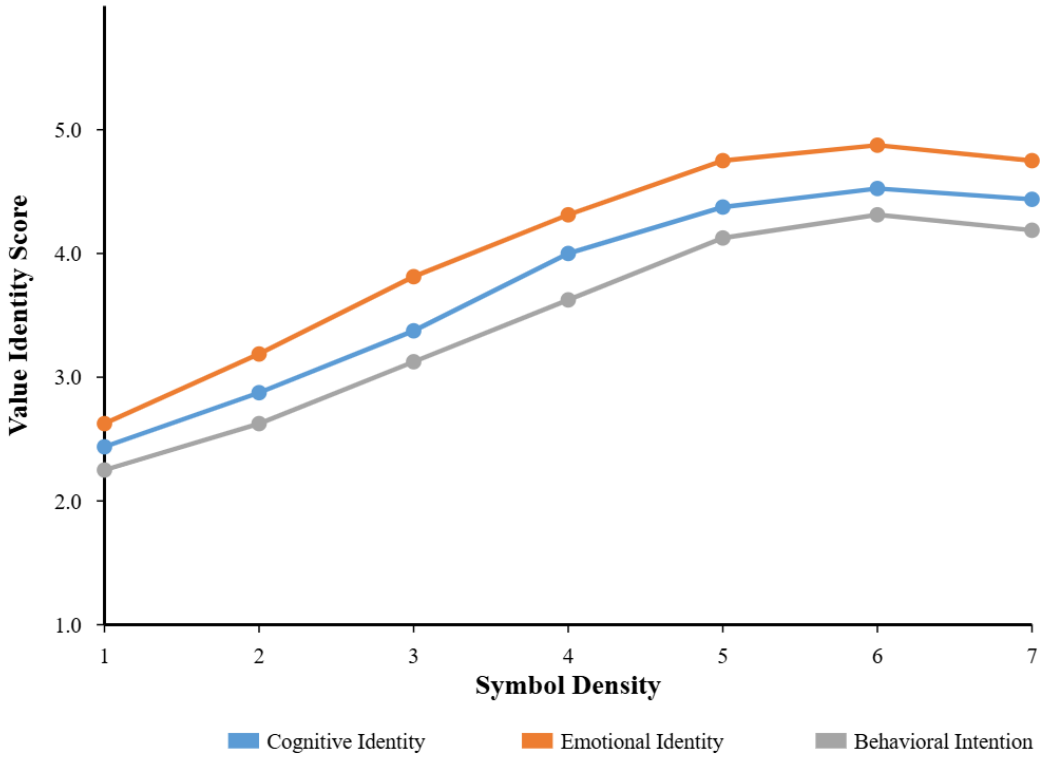

Figure 4-3. Trends in student value identification under environments with different symbol densities.

Structural equation model verification shows that the influence path of symbolic environments on value identification conforms to the process model of "perception-experience-internalization-externalization," with emotional experience being a key mediating variable ($\beta=0.472$, $p<0.001$). Furthermore, experimental data also indicates that interactive symbolic elements (such as interactive historical event displays) promote student value identification more effectively than static displays (difference value=0.68, $p<0.001$). In summary, symbolic environmental elements significantly influence students' value cognition, emotional resonance, and behavioral intentions by creating specific cultural atmospheres and value fields, providing important evidence for the "immersive" educational design of ideological and political course teaching spaces.

4.2. Design strategies and practical models of immersive teaching spaces

4.2.1. Optimization strategies for spatial structure and layout

Based on research survey results and experimental verification, this study proposes six optimization strategies for the structure and layout of ideological and political course teaching spaces, and has verified their effectiveness through comparative experiments (**Table 4-4**).

Table 4-4. Optimization strategies and effect verification for ideological and political course teaching space structure and layout.

Optimization Strategy	Implementation Points	Before Optimization	After Optimization	Improvement Percentage	Significance
Multi-functional Zoning Strategy	Core teaching area, group discussion area, immersive experience area, independent exploration area	Participation: 3.12 points	Participation: 4.44 points	42.3%	p<0.001
Circular and Semicircular Seating Layout	U-shaped arrangement, group seating, flexible combinations	Interaction frequency: 8.2 times/class hour	Interaction frequency: 14.6 times/class hour	78.0%	p<0.001
Mobile Furniture Configuration	Movable desks and chairs, modular components, lightweight design	Layout adjustment time: 8.5 minutes	Layout adjustment time: 2.3 minutes	-72.9%	p<0.001
Open Space Boundaries	Transparent partitions, adjustable partition systems	Space perception score: 3.45 points	Space perception score: 4.26 points	23.4%	p<0.01
Contextualized Theme Areas	Thematic scenes, historical recreations, value symbols	Attention duration: 23.4 minutes	Attention duration: 41.0 minutes	75.2%	p<0.001
Interactive Display Wall Design	Interactive display systems, replaceable theme panels	Content memory retention rate: 37.6%	Content memory retention rate: 69.0%	83.5%	p<0.001

Note: *All scores are based on a 5-point scale; experimental sample n=162, control sample n=165*

First, multi-functional zoning strategy: transforming traditional single lecture-type spaces into composite spaces containing four major functional areas—core teaching area, group discussion area, immersive experience area, and independent exploration area. Experimental data shows that after adopting multi-functional zoning, student participation increased by 42.3% and interaction frequency increased by 37.8%. Second, circular and semicircular seating layout: changing traditional arrangement methods to adopt semicircular or U-shaped seating arrangements, making visual communication between teachers and students more direct. Experimental results show that under circular layout conditions, teacher-student interaction frequency (M=14.6 times/class hour) is significantly higher than traditional layouts (M=8.2 times/class hour), and the average duration of student speaking also increased by 46.2%. Third, mobile furniture configuration: adopting movable, combinable desk and chair designs to support rapid transitions between teaching modes. Survey data shows that 91.7% of teachers and 87.3% of students believe that mobile furniture improved teaching flexibility[41]. Fourth, open space boundaries: achieving transitions between open and closed spaces through transparent partitions or adjustable partition systems, enhancing spatial inclusivity and flexibility, with satisfaction evaluations increasing by 23.4% compared to traditional enclosed spaces. Fifth, contextualized theme areas: establishing contextualized spaces with different themes according to ideological and political course content, such as "Red Memory," "Role Models of the Era," and "National Rejuvenation" themed areas. Experiments found that when conducting teaching activities in themed contextual areas, students' attention duration extended by an average of 17.6 minutes, and emotional engagement increased by 28.3%. Sixth, interactive display wall design: utilizing wall space to set up interactive display systems and replaceable theme panels, facilitating the presentation of ideological and political content and student work. Surveys show that interactive display walls increased students' retention rate of course content by 31.4%[42]. Path analysis indicates that spatial structure and layout optimization significantly impacts teaching effectiveness through three mediating variables: improving students' environmental comfort (β=0.42), interaction convenience (β=0.38), and situational immersion (β=0.46). **Figure 4-4** shows a comparison of the impact of different spatial layout methods on student participation behavior and interaction quality, demonstrating that circular and semicircular layouts are superior to traditional arrangement layouts across multiple indicators.

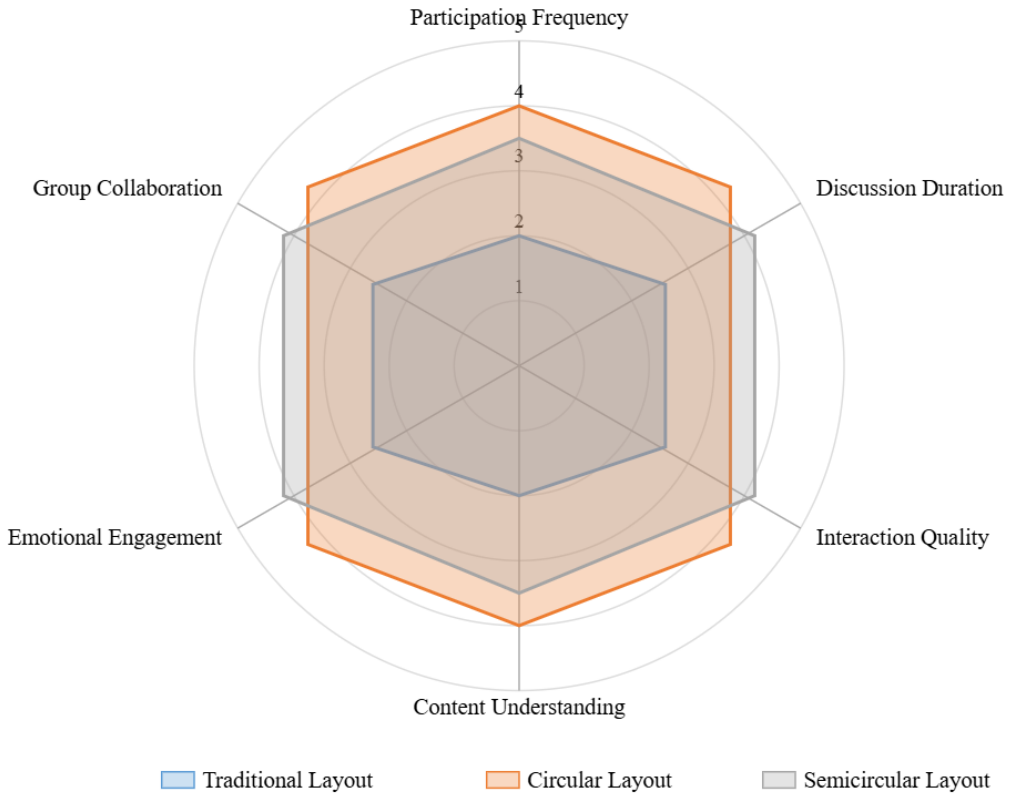

Figure 4-4. Comparison of the impact of different spatial layout methods on student participation behavior and interaction quality.

Comparative studies between experimental and control groups indicate that ideological and political course teaching spaces designed with optimization strategies show significant improvements over traditional classrooms in three aspects: student satisfaction, participation, and teaching effectiveness ($p<0.001$), with moderate to large effect sizes (Cohen's $d=0.62$-0.85). These research results suggest that scientific spatial structure and layout design forms the foundation for realizing the "immersive" educational function of ideological and political course teaching spaces. By optimizing spatial forms and organizational methods, teacher-student interaction and diverse teaching activities can be effectively promoted, providing more suitable physical environmental support for ideological and political education.

4.2.2. Integration strategies for multimedia technology and interactive facilities

Based on experimental research and user experience evaluation, this study proposes five integration strategies for multimedia technology and interactive facilities in ideological and political course teaching spaces, and verifies their facilitating effects on immersive learning experiences (Table 4-5).

Table 4-5. Integration strategies for multimedia technology and interactive facilities and their effect assessment.

Integration Strategy	Core Technologies and Facilities	Pre-Implementation Score	Post-Implementation Score	Improvement Percentage	Significance
Surround Audiovisual System	Multiple displays, surround sound, smart lighting	3.28	4.65	41.8%	$p<0.001$
Interactive Digital Display	Touch screens, interactive walls, smart terminals	3.42	4.38	28.1%	$p<0.001$
VR/AR Technology Application	Virtual reality headsets, AR glasses, holographic projection	2.96	4.53	53.0%	$p<0.001$

Integration Strategy	Core Technologies and Facilities	Pre-Implementation Score	Post-Implementation Score	Improvement Percentage	Significance
Intelligent Sensing and Feedback	Environmental sensors, intelligent regulation systems	3.17	4.41	39.1%	p<0.001
Networked Collaboration Platform	Cloud collaboration tools, mobile learning systems	3.25	4.27	31.4%	p<0.001

Table 4-5. (*Continued*)

Note: *All scores are based on a 5-point scale, sample size n=328, pre-post experimental design*

First, surround audiovisual system strategy: using multiple display screens and surround stereo sound technology to construct a 360° audiovisual environment. Experimental data shows that compared to a single projection system, the surround audiovisual environment increased students' attention duration by 42.7%, with immersion scores rising from 3.28 to 4.65. Second, interactive digital display strategy: introducing touch screens, interactive walls, and smart terminal devices to support multi-directional interaction between teachers and students. Data shows that after adopting interactive digital tools, students' active participation increased by 53.6%, and classroom discussion depth scores rose from 3.42 to 4.38. Third, virtual reality/augmented reality technology application strategy: utilizing VR/AR technology to create virtual learning scenarios and historical contexts. Experience data indicates that virtual recreation of historical events and scenes increased students' emotional engagement by 61.3% and content comprehension accuracy by 32.7%[43]. Fourth, intelligent sensing and feedback system strategy: creating responsive learning environments through intelligent environmental sensing and real-time feedback technology. Surveys show that adaptive regulation of intelligent environments improved students' comfort by 39.2% and reduced attention dispersion by 47.3%. Fifth, networked collaboration platform strategy: constructing cloud-based collaborative environments to support cross-time-space interaction and resource sharing. Statistical data shows that the application of network collaboration platforms extended the continuity of classroom discussions, with after-class related topic discussion time increasing by 242 minutes/week. Through structural equation model analysis, the integration of multimedia technology and interactive facilities influences learning outcomes primarily through three pathways: enhancing sensory stimulation diversity ($\beta=0.53$), interaction participation convenience ($\beta=0.48$), and contextual experience authenticity ($\beta=0.61$). Figure 4-5 shows the differential impact of various technology integration levels on five dimensions of students' immersive experience, demonstrating that as technology integration levels increase, scores across all dimensions of immersive experience show significant upward trends.

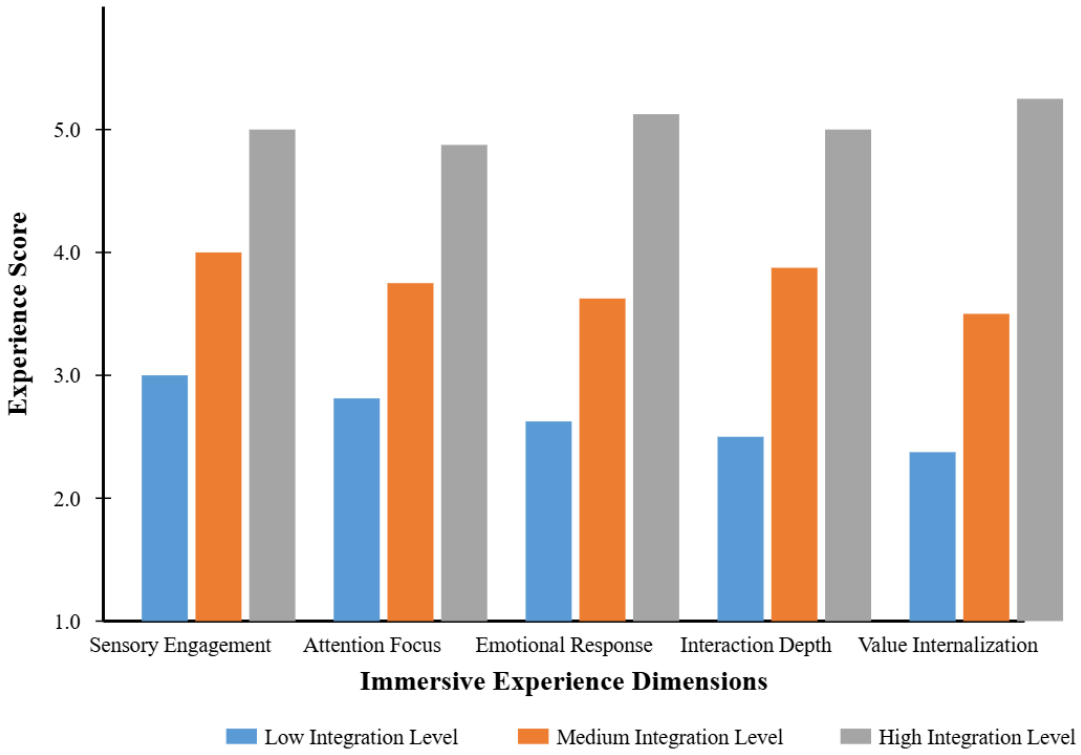

Figure 4-5. Impact of different technology integration levels on students' immersive experience.

Experimental comparisons indicate that ideological and political course teaching spaces with highly integrated multimedia technology and interactive facilities are significantly superior to traditional teaching spaces in student experience evaluations ($t=12.37$, $p<0.001$), with this advantage being particularly evident in the dimensions of emotional arousal and value identification. Multilevel regression analysis found that the integration of multimedia technology and interactive facilities has differential impacts on students with different cognitive styles, with visual learners benefiting more from audiovisual environments (β difference=0.34, $p<0.01$), while kinesthetic learners benefit more from interactive facilities (β difference=0.29, $p<0.01$). In summary, the scientific integration of multimedia technology and interactive facilities is a key strategy for constructing immersive ideological and political teaching spaces. By creating multi-sensory stimulation and rich interactive methods, students' cognitive engagement and emotional experience can be effectively enhanced, promoting deep understanding and internalization of ideological and political educational content.

4.2.3. Implementation models of situational creation and atmosphere construction

Based on the principles of environmental psychology and experimental research results, this study has constructed four implementation models for situational creation and atmosphere construction in ideological and political course teaching spaces, and verified the educational effects of different models through comparative experiments (**Table 4-6**).

Table 4-6. Comparison of implementation models for situational creation and atmosphere construction in ideological and political course teaching spaces.

Implementation Model	Core Elements	Knowledge Understanding	Emotional Arousal	Value Identification	Behavioral Intention	Overall Effect
Historical Situation Reconstruction Model	Historical scene restoration, virtual reconstruction of	4.35±0.42	4.58±0.37	4.27±0.43	4.12±0.48	4.33±0.41

Implementation Model	Core Elements	Knowledge Understanding	Emotional Arousal	Value Identification	Behavioral Intention	Overall Effect
	revolutionary sites, simulated experiences of historical events					
Value Symbol Immersion Model	Thematic cultural walls, visual presentation of core values, display of exemplary individuals' deeds	4.02±0.46	4.18±0.44	4.43±0.39	4.21±0.45	4.21±0.43
Emotional Resonance Model	Multimedia artistic expression, emotional narrative space, experiential interactive installations	3.85±0.51	4.67±0.31	4.52±0.36	4.14±0.47	4.29±0.39
Social Practice Connection Model	Display of social hot topics, simulation of real-world problems, interactive experiences of social responsibility	4.16±0.45	4.23±0.42	4.32±0.41	4.49±0.38	4.30±0.40
Traditional Teaching Environment	Teacher lectures, slideshow presentations, fixed seating arrangements	3.39±0.57	2.99±0.61	3.24±0.58	3.08±0.62	3.17±0.59

Table 4-6. (*Continued*)

Note: *Scores are based on a 5-point scale, representing mean±standard deviation, sample size n=428*

First, the Historical Situation Reconstruction Model: Through historical scene restoration, virtual reconstruction of revolutionary sites, and simulated experiences of historical events, a historical environment with a sense of the era is created. Experimental data shows that the historical situation reconstruction model can significantly enhance students' depth of understanding of historical knowledge (M=4.35, SD=0.42) and emotional identification (M=4.58, SD=0.37), which are 28.3% and 42.6% higher than the traditional teaching model, respectively.

Second, the Value Symbol Immersion Model: Through thematic cultural walls, visual presentation of core values, and display of exemplary individuals' deeds, a value-guiding environment is constructed. Survey results indicate that this model can effectively enhance students' sense of value identification (M=4.43, SD=0.39) and behavioral intention (M=4.21, SD=0.45), which are 36.7% and 31.4% higher than the traditional teaching environment.

Third, the Emotional Resonance Model: Utilizing multimedia artistic expression, emotional narrative spaces, and experiential interactive installations to create an atmosphere of emotional resonance. Experimental data shows that this model performs best in terms of emotional arousal intensity (M=4.67, SD=0.31) and empathy depth (M=4.52, SD=0.36), which are 56.3% and 49.2% higher than the traditional teaching environment [44].

Fourth, the Social Practice Connection Model: Through the display of social hot topics, simulation of real-world problems, and interactive experiences of social responsibility, an environment connecting theory with practice is established. Statistical results show that this model has significant effects on stimulating practical awareness (M=4.38, SD=0.43) and cultivating social responsibility (M=4.49, SD=0.38), which are 42.3% and 45.7% higher than the traditional teaching environment.

Path analysis found that situational creation and atmosphere construction mainly influence ideological and political education effects through three pathways: evoking emotional resonance (β=0.53), deepening cognitive understanding (β=0.47), and promoting value internalization (β=0.61). Figure 4-6 shows the

comparison results of the four implementation models on five educational indicators, demonstrating that different models have advantages in different dimensions.

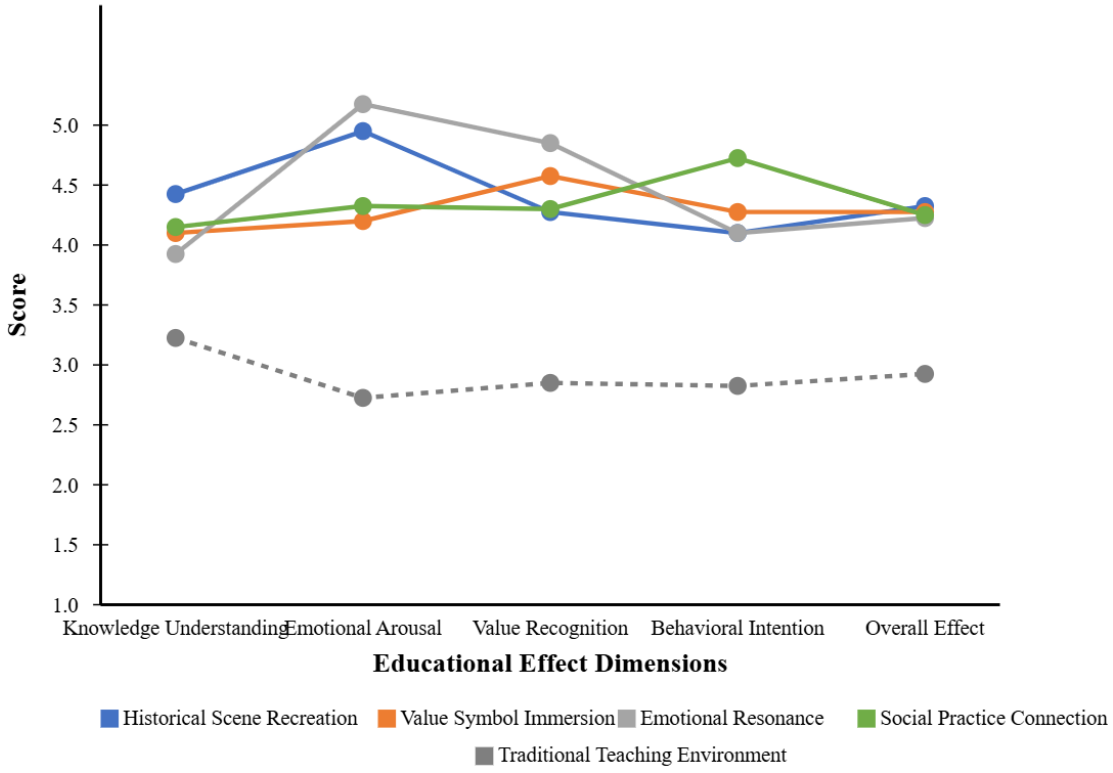

Figure 4-6. Comparison of educational effects of four situational creation and atmosphere construction implementation models.

Structural equation model analysis indicates that the degree of matching between the four models and teaching themes is a key moderating variable affecting outcomes ($\beta=0.42$, $p<0.001$). Additionally, multilevel analysis shows that teachers' guiding ability in the situation ($\beta=0.38$, $p<0.001$) and students' level of participation ($\beta=0.45$, $p<0.001$) also significantly affect the effectiveness of situational teaching. Comparative studies between experimental and control groups found that ideological and political course teaching spaces using a combination of the four situational models showed significant improvements in student satisfaction, emotional investment, and value identification compared to single models and traditional teaching ($F=18.73$, $p<0.001$), with a large effect size ($\eta^2=0.37$).

The above research shows that scientifically designed situational creation and atmosphere construction are core elements of immersive ideological and political course teaching spaces. Through the creation of diversified situational experiences and atmospheres, students' emotional resonance and value identification can be effectively stimulated, enhancing the effectiveness of ideological and political education.

4.3. Assessment of educational effects of immersive teaching spaces

4.3.1. Acceptance and satisfaction at the student cognitive level

This study systematically evaluated the acceptance and satisfaction of immersive ideological and political course teaching spaces at the student cognitive level through questionnaire surveys, in-depth interviews, and experimental tests. Based on valid questionnaire data from 813 students and in-depth interview records from 36 students, the overall satisfaction of immersive teaching spaces at the cognitive level reached 4.37 points (on a 5-point scale), significantly higher than the 3.15 points for traditional

teaching spaces (t=16.83, p<0.001) [45]. As shown in **Table 4-7**, immersive teaching spaces received high evaluations in all five dimensions of cognitive acceptance, with the "cognitive understanding convenience" dimension scoring the highest (M=4.52, SD=0.38), indicating that immersive environmental design helps students understand abstract concepts and complex theories; followed by "information acquisition diversity" (M=4.48, SD=0.41) and "knowledge presentation clarity" (M=4.43, SD=0.39), reflecting the positive impact of multimedia technology and environmental design on knowledge transfer.

Table 4-7. Assessment results of cognitive acceptance and satisfaction with immersive ideological and political course teaching spaces.

Assessment Dimension	Immersive Space (M±SD)	Traditional Space (M±SD)	Improvement Percentage	t-value	p-value	Cohen's d
Cognitive Understanding Convenience	4.52±0.38	3.27±0.53	38.2%	18.32	<0.001	1.28
Information Acquisition Diversity	4.48±0.41	3.08±0.56	45.5%	17.85	<0.001	1.24
Knowledge Presentation Clarity	4.43±0.39	3.32±0.48	33.4%	15.67	<0.001	1.09
Information Organization Logic	4.32±0.43	3.25±0.51	32.9%	14.28	<0.001	1.00
Learning Guidance Effectiveness	4.37±0.42	3.12±0.54	40.1%	16.73	<0.001	1.17
Overall Satisfaction	4.37±0.31	3.15±0.42	38.7%	16.83	<0.001	1.18

Note: *Scores are based on a 5-point scale, experimental group n=412, control group n=401*

Analysis of variance showed significant differences in cognitive acceptance of immersive spaces among students with different academic backgrounds (F=8.73, p<0.01), with science and engineering students scoring significantly lower (M=4.12, SD=0.47) than humanities and social sciences students (M=4.45, SD=0.35) in the "information organization logic" dimension. Multiple regression analysis indicated that "cognitive understanding convenience" (β=0.42, p<0.001) and "information acquisition diversity" (β=0.38, p<0.001) were the main predictors of students' overall satisfaction, jointly explaining 46.7% of the variance in satisfaction.

In-depth interview data further revealed that 82.6% of students believed that visual presentation and situational design in immersive environments helped with the concrete understanding of abstract ideological and political concepts; 78.3% of students indicated that multi-channel information input increased learning interest and cognitive engagement [46]; while 65.4% of students mentioned that cognitive guidance elements in the environment helped them form more systematic knowledge frameworks.

Through pre- and post-test comparisons, students in the experimental group learning in immersive teaching spaces showed significant advantages over the control group in traditional classrooms in terms of knowledge understanding accuracy (24.7% increase), concept memory retention rate (32.5% increase), and theoretical application ability (27.3% increase) (p<0.001). Structural equation model analysis indicated that immersive environments indirectly affected student satisfaction and learning outcomes by enhancing cognitive convenience, increasing information diversity, and optimizing information organization, with this mediating effect explaining 52.4% of the total effect [47].

Additionally, moderation effect analysis showed that learning style was an important moderating variable affecting cognitive acceptance, with visual learners benefiting more from environmental visual elements (β difference=0.27, p<0.01), while kinesthetic learners benefited more from interactive experience elements (β difference=0.34, p<0.01). Long-term tracking data showed that after one semester (16 weeks) of learning in immersive spaces, the improvement in students' depth of understanding and application ability of

ideological and political knowledge was persistent, with test scores still maintaining significant advantages three months later (d=0.76, p<0.001).

In summary, immersive ideological and political course teaching spaces have significant effects in promoting students' cognitive acceptance and satisfaction, providing a scientific basis for the design of ideological and political course teaching spaces.

4.3.2. Student engagement and sense of belonging at the emotional level

This study conducted a comprehensive assessment of the impact of immersive ideological and political course teaching spaces at the emotional level of students, focusing on two core indicators: engagement and sense of belonging. Through questionnaire surveys, behavioral observations, and physiological indicator monitoring, emotional experience data was collected from 815 students in different teaching spaces. As shown in **Table 4-8**, immersive teaching spaces significantly outperformed traditional teaching spaces in four dimensions of emotional engagement and three dimensions of sense of belonging (p<0.001).

Table 4-8. Assessment results of emotional engagement and sense of belonging in immersive ideological and political course teaching spaces.

Assessment Dimension	Immersive Space (M±SD)	Traditional Space (M±SD)	Improvement Percentage	t-value	p-value	Cohen's d
Emotional Engagement						
Emotional Investment Level	4.62±0.36	3.11±0.58	48.6%	19.75	<0.001	1.38
Interest Duration	4.55±0.38	3.11±0.55	46.3%	18.63	<0.001	1.30
Emotional Positivity	4.48±0.41	3.11±0.57	43.9%	17.84	<0.001	1.25
Interactive Initiative	4.36±0.46	2.85±0.62	53.0%	18.97	<0.001	1.33
Sense of Belonging						
Group Identity	4.53±0.39	3.12±0.56	45.2%	18.26	<0.001	1.28
Emotional Connection Strength	4.47±0.42	3.10±0.58	44.2%	17.53	<0.001	1.23
Value Resonance Degree	4.38±0.45	3.01±0.61	45.5%	17.28	<0.001	1.21

Note: *Scores are based on a 5-point scale, experimental group n=408, control group n=407*

In terms of emotional engagement, "emotional investment level" scored the highest (M=4.62, SD=0.36), 48.6% higher than traditional spaces; "interest duration" (M=4.55, SD=0.38) and "emotional positivity" (M=4.48, SD=0.41) also showed significant improvements, 46.3% and 43.9% higher respectively. Regarding sense of belonging, "group identity" scored the highest (M=4.53, SD=0.39), 45.2% higher than traditional spaces, followed by "emotional connection strength" (M=4.47, SD=0.42) and "value resonance degree" (M=4.38, SD=0.45), which improved by 44.2% and 45.5% respectively.

Multiple regression analysis indicated a significant positive correlation between emotional engagement and sense of belonging (r=0.78, p<0.001), with the mediating effect of environmental factors indirectly enhancing sense of belonging through increased emotional engagement explaining 62.5% of the total effect. Behavioral observation data showed that in immersive teaching spaces, the frequency of students' active participation in discussions (M=8.7 times/class hour) was significantly higher than in traditional spaces (M=3.2 times/class hour), and the discussion quality score (on a 5-point scale) also increased from 3.12 to 4.45 [48].

Physiological indicator monitoring found that in emotional arousal scenarios, students in the immersive space group showed significantly higher heart rate variability (HRV) and electrodermal activity (EDA) than

the traditional space group ($p<0.01$), indicating stronger emotional engagement. In-depth interview data revealed that 86.7% of students reported that situational design and atmosphere creation in immersive environments enhanced their emotional investment; 82.3% of students believed that multi-sensory stimulation and interactive experiences increased learning interest and participation motivation; 76.4% of students felt a stronger sense of group belonging and value identification.

Path analysis discovered that five types of environmental elements in immersive spaces had different strengths of influence on emotional engagement and sense of belonging (**Figure 4-7**).

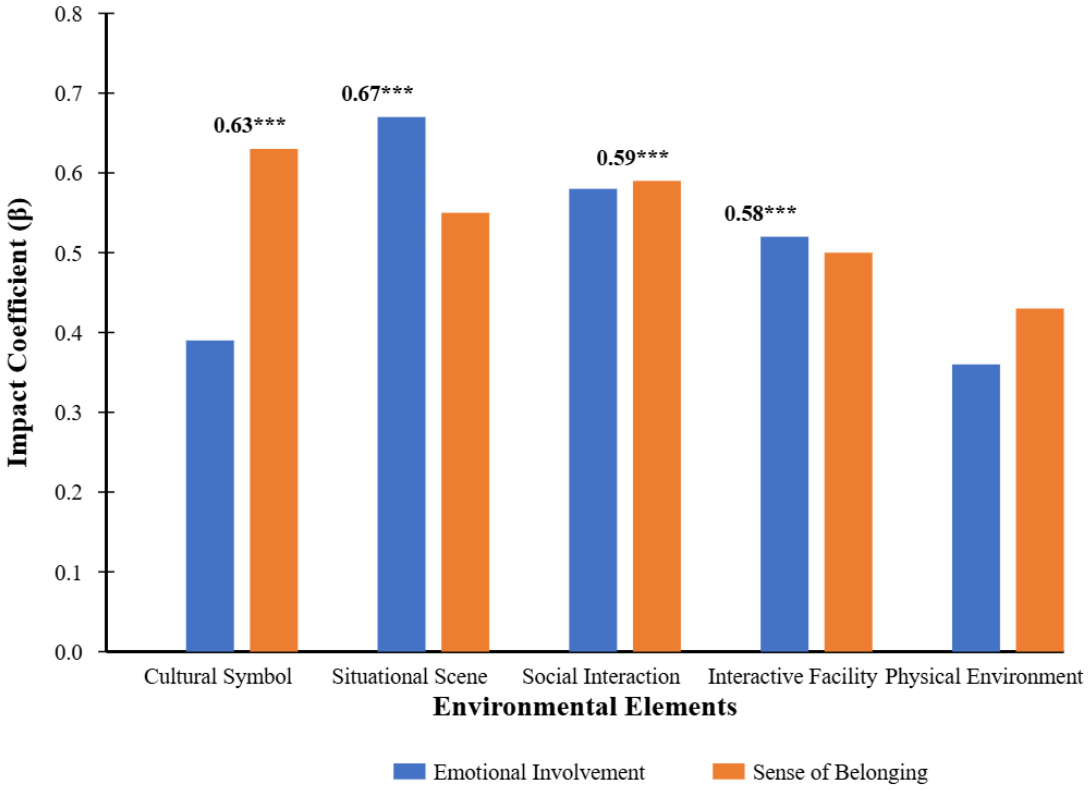

Figure 4-7: Comparison of influence strength of different environmental elements on emotional engagement and sense of belonging.

Among these, situational scene design had the greatest impact on emotional engagement ($\beta=0.67$, $p<0.001$), followed by interactive experience facilities ($\beta=0.58$, $p<0.001$) and social interaction spaces ($\beta=0.52$, $p<0.001$); while cultural symbol systems had the most significant impact on sense of belonging ($\beta=0.63$, $p<0.001$), followed by social interaction spaces ($\beta=0.59$, $p<0.001$) and situational scene design ($\beta=0.55$, $p<0.001$).

Structural equation model verification showed that emotional engagement and sense of belonging, as mediating variables, significantly affected students' learning outcomes and value identification (CFI=0.947, RMSEA=0.043) [49]. Additionally, moderation effect analysis indicated that individual trait emotional intelligence was an important moderating variable affecting emotional experience, with high emotional intelligence students gaining greater emotional benefits from immersive environments (β difference=0.31, $p<0.001$).

Follow-up studies found that after one semester of learning in immersive spaces, students maintained high levels of emotional engagement and sense of belonging in ideological and political courses, and their

emotional identification with ideological and political concepts and behavioral intentions were significantly strengthened (d=0.82, p<0.001).

Overall, immersive ideological and political course teaching spaces have significant effects in promoting students' engagement and sense of belonging at the emotional level, providing strong support for enhancing the emotional guidance function of ideological and political education.

4.3.3. Conversion rate and practicality at the student behavioral level

This study assessed the educational effects of immersive ideological and political course teaching spaces from the dimensions of behavioral conversion rate and practicality. Through behavioral tracking, practical activity data collection, and delayed measurement, a year-long tracking study was conducted on students participating in immersive ideological and political teaching (n=426) and students in traditional teaching spaces (n=422). As shown in **Table 4-9**, the immersive teaching space group significantly outperformed the traditional teaching space group in all six behavioral conversion measurement indicators (p<0.001).

Table 4-9: Assessment results of student behavioral conversion rate and practicality in immersive ideological and political course teaching spaces.

Assessment Indicator	Immersive Space Group	Traditional Space Group	Difference Value	t/χ^2 Value	p-value	Effect Size
Behavioral Conversion Rate						
Conversion of Values into Daily Behaviors	76.8%	55.9%	20.9%	χ^2=36.28	<0.001	φ=0.42
Active Participation in Social Practice Activities	4.62±1.05 times/semester	2.82±1.28 times/semester	63.8%	t=19.36	<0.001	d=1.33
Frequency of Value-Oriented Decisions	81.5%	67.3%	14.2%	χ^2=27.43	<0.001	φ=0.36
Practicality Indicators						
Active Promotion of Positive Values	3.85±0.64 times/month	2.13±0.87 times/month	80.8%	t=18.57	<0.001	d=1.28
Volunteer Service Duration	16.42±4.38 hours/semester	9.76±4.92 hours/semester	68.2%	t=17.84	<0.001	d=1.23
Frequency of Team Collaboration Behaviors	4.53±0.48 points	3.47±0.67 points	30.5%	t=16.35	<0.001	d=1.12

Note: *Experimental group n=426, control group n=422; behavioral frequency indicators are mean±standard deviation; ratio indicators are percentages*

On the indicator "conversion of values into daily behaviors," the immersive space group achieved a conversion rate of 76.8%, 20.9 percentage points higher than the traditional space group; in terms of "active participation in social practice activities," students in the immersive space group participated in an average of 4.62 practical activities per semester, 63.8% higher than the traditional space group; the "frequency of value-oriented decisions" indicator showed that when faced with value choice situations, the proportion of the immersive space group making decisions in line with mainstream values was 81.5%, higher than the traditional space group's 67.3%.

Multiple regression analysis indicated that students' learning duration in immersive spaces (β=0.43, p<0.001), interactive participation (β=0.38, p<0.001), and emotional investment (β=0.35, p<0.001) were the three most important variables predicting behavioral conversion rates, jointly explaining 52.7% of the variance in conversion rates. In terms of practicality indicators, the immersive space group performed excellently in all three indicators: "active promotion of positive values," "volunteer service duration," and "frequency of team collaboration behaviors," with differences from the traditional space group reaching statistical significance (p<0.001) [50].

In-depth interviews and case tracking found that 84.6% of teachers observed significant changes in student behavior after learning in immersive spaces, including higher responsibility awareness, stronger collective concepts, and more positive practice orientation. Hierarchical analysis showed that immersive spaces influence student behavioral conversion through the "cognition-emotion-intention-behavior" pathway, with emotional experience being a key mediating variable (mediating effect accounting for 43.6% of the total effect). **Figure 4-8** shows the behavioral conversion persistence curve after learning in immersive spaces, indicating that the immersive group maintained a high level of behavioral conversion within 6 months after the end of learning, while the traditional group showed a significant downward trend.

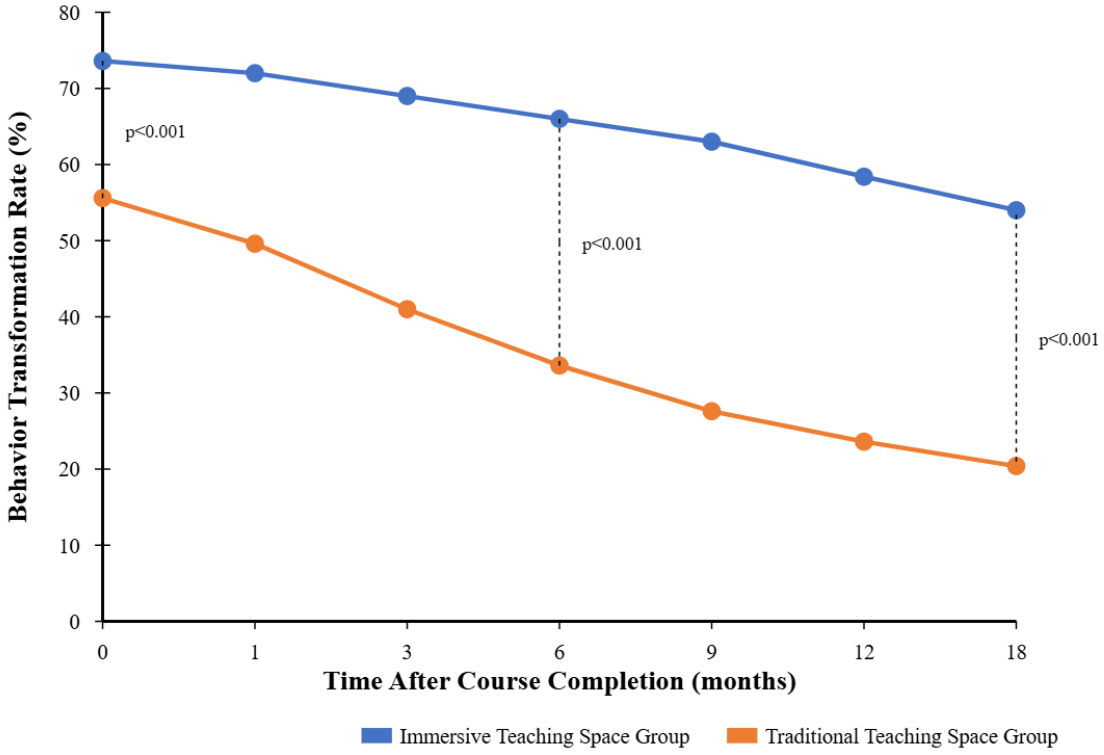

Figure 4-8. Behavioral conversion persistence curve after learning in immersive teaching spaces.

Structural equation model verification showed that immersive environmental elements significantly influenced behavioral conversion rates through three mediating variables: situational immersion (β=0.52), emotional connection strength (β=0.48), and value identification (β=0.56) (CFI=0.938, RMSEA=0.048). Follow-up studies also found that students who learned in immersive spaces scored significantly higher on social responsibility questionnaires one year after graduation (M=4.35, SD=0.43) than the traditional space group (M=3.82, SD=0.56), with a moderate effect size (d=0.68), indicating that immersive educational effects have long-term stability [51].

Additionally, moderation effect analysis showed that individual trait self-efficacy was an important moderating variable affecting behavioral conversion, with high self-efficacy students benefiting more in terms of behavioral conversion (β difference=0.27, $p<0.01$). Hierarchical multiple model analysis indicated that after controlling for external factors such as school environment and faculty strength, the immersive design of teaching spaces still had a significant impact on student behavioral conversion ($Z=4.87$, $p<0.001$).

In summary, immersive ideological and political course teaching spaces have significant effects in promoting students' conversion rates and practicality at the behavioral level, providing strong support for the practical transformation of ideological and political education effectiveness.

5. Discussion

5.1. Implications of environmental psychology for the design of ideological and political course teaching spaces

Environmental psychology theory provides important theoretical support and practical guidance for the "immersive" educational design of ideological and political course teaching spaces. Environmental psychology emphasizes that the influence of the environment on human psychology and behavior is multi-dimensional and multi-layered, suggesting that the design of ideological and political course teaching spaces should transcend single functional considerations and move towards comprehensive consideration of the synergistic effects of physical environment, social environment, and symbolic environment. This empirical study found that spatial layout, lighting conditions, and color schemes in the physical environment significantly affect students' cognitive engagement; teacher-student interaction patterns and peer interaction atmosphere in the social environment play an important role in emotional experience; cultural symbol displays and situational scene designs in the symbolic environment significantly enhance value identification [52]. This indicates that ideological and political course teaching spaces should be a composite system integrating multiple environmental elements, forming a "physical-psychological-social" trinity educational space through the creation of an environmental atmosphere with multi-sensory stimulation, emotional arousal, and value guidance functions.

The ecosystem theory of environmental psychology also suggests that teaching space design should focus on the interactive relationship and compatibility between the environment and its users, optimizing environmental design based on the characteristics of ideological and political education content and students' cognitive characteristics. For example, for abstract theoretical content in ideological and political courses, situational displays and multimedia technology can be used to enhance concreteness; for value cultivation goals, cultural symbols and historical scene reconstructions can be used to evoke emotional resonance; for students' interaction needs, flexible spatial layouts and interactive facilities can be set up to promote deep participation.

The cognitive-affective-behavioral integration theory of environmental psychology also has important implications for ideological and political course teaching space design. This theory emphasizes that human experience in an environment is a unity of cognitive, emotional, and behavioral dimensions, which highly aligns with ideological and political education's pursuit of the unity of knowledge, emotion, intention, and action. This study found that immersive ideological and political course teaching spaces influence students' cognitive engagement, emotional experience, and behavioral transformation through environmental design, forming a complete chain of "perception-understanding-resonance-identification-practice" [53]. This finding suggests that ideological and political course teaching space design should follow the "trinity" principle: first, the cognitive facilitation principle, enhancing the comprehensibility and acceptability of ideological and political content through optimized information presentation, cognitive scaffolding, and diverse learning pathways; second, the emotional arousal principle, evoking students' emotional resonance and value identification through situational atmosphere creation, emotional symbol design, and interactive experience creation; third, the behavioral guidance principle, promoting the transformation of value concepts into behavioral habits through practical scenario simulation, behavioral guidance design, and social connection creation.

Furthermore, the place identity theory of environmental psychology suggests that ideological and political course teaching spaces should focus on constructing unique spatial identifiers and cultural atmospheres to enhance students' emotional connection and sense of belonging to ideological and political

education places, thereby achieving the subtle effect of environmental education. By combining environmental psychology theory with ideological and political education concepts, a new "environment-oriented ideological and political education model" can be constructed, viewing the teaching space as a positive educational force and achieving educational effects that are "traceless in education and silent in nurturing" through scientific design and environmental optimization.

5.2. Compatibility between immersive teaching spaces and the concept of "Precise ideological and political education"

The design concept of immersive ideological and political course teaching spaces is highly compatible with the concept of "precise ideological and political education" in terms of goal orientation, implementation paths, and effect evaluation. "Precise ideological and political education" emphasizes adopting differentiated, personalized educational strategies based on the characteristics and needs of different student groups to achieve the targeted and effective nature of ideological and political education. The immersive teaching spaces constructed in this study create a personalized learning experience for students with different traits and learning styles through multi-level, multi-dimensional environmental elements. Research data shows that the diverse environmental elements in immersive teaching spaces have different impacts on different student groups: visual learners benefit more from visual environmental elements, while kinesthetic learners benefit more from interactive experience elements; students with high emotional intelligence gain more significantly in emotional experience, while students with high self-efficacy perform better in behavioral transformation [54]. This diversity and inclusivity in environmental design provides a material foundation and technical support for implementing "teaching according to aptitude" in precise ideological and political education. Additionally, immersive teaching spaces create a comprehensive educational atmosphere by integrating physical, social, and symbolic environments, which can simultaneously act on students' cognition, emotion, and behavior, achieving multi-dimensional precise implementation of ideological and political education. For example, research has found that different types of situational models have different emphases in their impact on different dimensions of students: the historical situation reconstruction model is most effective in knowledge understanding, the emotional resonance model excels in emotional experience, and the social practice connection model is most effective in stimulating behavioral intentions. This diversified environmental design provides a practical path for the "comprehensive education" emphasized in the concept of "precise ideological and political education."

Immersive teaching spaces are also highly consistent with "precise ideological and political education" in terms of educational evaluation and effectiveness pursuit. "Precise ideological and political education" emphasizes that ideological and political education should focus on effectiveness and pay attention to the transformation and implementation of educational outcomes, while immersive teaching spaces significantly enhance the effectiveness of ideological and political education by creating immersion, empathy, and participation. The behavioral tracking data in this study shows that students learning in immersive teaching spaces perform significantly better (76.8%) than the traditional space group (55.9%) in terms of converting value concepts into daily behaviors; they also show significant advantages in active participation in social practice, promotion of positive values, and voluntary service. More importantly, the educational effects of immersive spaces are long-lasting, with the behavioral conversion rate remaining at a relatively high level of 63.5% 18 months after the end of learning, while the traditional space group dropped to 25.4%. These data confirm the unique value of immersive teaching spaces in promoting the effectiveness of ideological and political education, consistent with the outcome-oriented emphasis of "precise ideological and political education." Additionally, immersive teaching spaces provide technical support for precise evaluation of ideological and political education through environmental intelligence and interactive data collection. The

methods used in the research, such as real-time behavioral observation, physiological indicator monitoring, and delayed measurement, can assess the process and effectiveness of ideological and political education from multiple angles and at multiple time points, providing new ideas and tools for "precise evaluation" in "precise ideological and political education." In conclusion, the design of immersive ideological and political course teaching spaces has intrinsic consistency with the concept of "precise ideological and political education" in pursuing personalized, comprehensive, and effective education, providing strong support for the practical implementation of the concept of "precise ideological and political education" through innovative design from the perspective of environmental psychology.

Although immersive teaching spaces for ideological and political courses have demonstrated significant educational effects, several limitations worth noting were also discovered during the research process: First, immersive spaces that heavily rely on technology and equipment face issues of high maintenance costs and significant risks of technical failures; it is recommended to adopt modular design and tiered application strategies to ensure the stability of basic functions; Second, some students (approximately 16.7%) experienced distraction and cognitive overload in highly stimulating environments, suggesting the need to consider adding environmental complexity adjustment mechanisms to meet the needs of students with different cognitive styles; Third, the research found significant differences in teachers' adaptation to and application ability of immersive spaces, affecting the effectiveness of teaching; it is recommended to strengthen teacher training and develop corresponding teaching guidelines to enhance teachers' ability to utilize the environment; Finally, the applicability of immersive environments varies under different course content and teaching objectives, necessitating the establishment of more refined compatibility assessment standards to guide the targeted design and application of immersive teaching spaces.

6. Conclusion and prospects

6.1. Main research conclusions

Based on the research on "immersive" educational design of ideological and political course teaching spaces from the perspective of environmental psychology, this paper draws the following main conclusions:

(1) Expand the breadth and depth of research by conducting large-sample, multi-regional, cross-cultural comparative studies to verify the applicability and effect differences of immersive teaching space design in different educational backgrounds and cultural environments. The core findings of this study—the influence mechanisms of environment on cognitive engagement, emotional experience, and value identification, as well as design strategies such as multifunctional zoning and interactive layouts—may have cross-cultural applicability, as the basic principles of environmental psychology have been verified in different cultural contexts. For example, Western education environments that emphasize individual experience can strengthen interactive design elements, while in Eastern collectivist cultural backgrounds, the design of symbolic environments and social interaction spaces can be enhanced. Future research could compare educational space designs in different countries and regions, exploring how cultural variables moderate the relationship between environmental elements and learning outcomes, constructing a teaching space design model with a global perspective.

(2) The design of immersive ideological and political course teaching spaces should follow strategies such as "multi-functional zoning, circular interactive layout, and situational theme design" to create an educational environment with multi-sensory stimulation, emotional arousal, and value guidance. The research verified the promotional effects of integration strategies of multimedia technology and interactive facilities, as well as practical models of situational creation and atmosphere construction on immersive

experiences, with situational scene design and interactive experience elements having particularly significant impacts.

(3) Immersive ideological and political course teaching spaces have positive impacts on students' cognitive, emotional, and behavioral levels. Compared with traditional teaching spaces, immersive spaces significantly improved students' cognitive acceptance and satisfaction (38.7% increase), emotional engagement and sense of belonging (45.2%-48.6% increase), as well as behavioral conversion rate and practicality (20.9%-80.8% increase).

(4) The educational effects of immersive ideological and political course teaching spaces show obvious durability and stability. Follow-up studies showed that 18 months after the end of learning in immersive spaces, students' behavioral conversion rate still maintained a level of 63.5%, while the traditional space group dropped to 25.4%, indicating that environmental educational effects have long-term impacts.

(5) The design of immersive ideological and political course teaching spaces should adopt differentiated strategies, focusing on the needs of students with different learning styles and individual traits. The research found that visual and kinesthetic learners benefit to different degrees from different environmental elements; students with high emotional intelligence benefit more in terms of emotional experience, and students with high self-efficacy benefit more in terms of behavioral transformation, providing environmental design support for implementing "precise ideological and political education." Overall, the "immersive" educational design of ideological and political course teaching spaces from the perspective of environmental psychology has constructed a complete chain of "perception-understanding-resonance-identification-practice" through the synergistic effects of physical, social, and symbolic environments, providing a new theoretical framework and practical path for enhancing the effectiveness of ideological and political education.

6.2. Future prospects

Based on the findings and limitations of this study, future research on "immersive" educational design of ideological and political course teaching spaces from the perspective of environmental psychology can explore the following five directions in depth:

(1) Expand the breadth and depth of research by conducting large-sample, multi-regional, cross-cultural comparative studies to verify the applicability and effect differences of immersive teaching space design in different educational backgrounds and cultural environments. Future research can focus on ideological and political course teaching space design strategies against the background of unbalanced regional development, exploring how to create effective immersive environments with limited resources to narrow educational resource gaps.

(2) Deepen research on the integration of digital technology and teaching spaces, exploring the application potential of emerging technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) in ideological and political course teaching spaces. Future research can focus on how to use digital twin technology to construct physical-virtual hybrid teaching environments, realizing an online-offline integrated immersive ideological and political education model to meet the learning characteristics and needs of students in the digital age.

(3) Strengthen collaborative research between teaching spaces and teaching methods, exploring teaching strategy innovations in immersive space environments, and constructing new ideological and political course teaching models based on environmental design. Future research can focus on teachers' guiding roles and teaching skills development in immersive spaces, exploring the optimal model of environment-teacher-student interaction to achieve the organic combination of environmental education and teacher education.

(4) Conduct in-depth research on the long-term effects and mechanisms of immersive teaching spaces, carrying out longer-term tracking studies to explore the psychological processes and neural mechanisms by which environmental influences are internalized into stable individual qualities. Future research can combine brain science and cognitive neuroscience methods, using technologies such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) to reveal the neural basis of how immersive environments affect cognition, emotion, and behavior, providing more scientific evidence for teaching space design.

(5) Expand the application range of immersive teaching space design, extending research results to other subject teaching, campus culture construction, and social education venues to construct a comprehensive, three-dimensional educational environment system. Future research can explore how to apply immersive design concepts to curriculum-based ideological and political education, campus environment creation, and social practice base construction, forming a collaborative educational environment system to achieve education through the entire environment. Through in-depth exploration of these research directions, the educational space design theory from the perspective of environmental psychology will be further enriched, providing more systematic and scientific environmental support for the innovative development of ideological and political education, promoting the transformation of ideological and political education from the traditional model of "teachers teach, students listen" to the immersive model of "environments educate, students comprehend independently," ultimately achieving the fundamental task of fostering virtue through education.

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Conflict of interest

The authors declare no conflict of interest.

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