Research on College Students' Emotional Alienation in the Context of Digital Education: A Case Study of Wuhan College of Arts and Sciences

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ABSTRACT

The objectives of this research were: 1) to investigate the prevalence of students' emotional alienation in digital learning environments; 2) to explore the influencing factors and formation mechanisms of emotional alienation among college students; and 3) to develop targeted intervention strategies for alleviating emotional alienation. This study employed a mixed-methods design targeting undergraduates from Wuhan College of Arts and Sciences as the research population, using stratified random sampling to select 390 participants for quantitative questionnaire survey and purposeful sampling to select 30 students, teachers, and counselors for qualitative semi-structured interviews, with data analyzed via SPSS 26.0, AMOS 24.0, and NVivo 12.

Major Findings included: 1) On the current status of emotional alienation, it was found that students reported a moderate level of emotional alienation ($M = 3.18$, $SD = 0.64$), with online learning burnout as the most severe dimension ($M = 3.42$, $SD = 0.72$) and significant differences across grades and majors; 2) On the correlation between influencing factors and emotional alienation, it was found that digital learning load was positively correlated with emotional alienation ($r = 0.51$, $p < 0.01$), while platform interaction quality and teacher emotional engagement were negatively correlated ($r = -0.42, -0.58$, $p < 0.01$), teacher emotional engagement played a significant partial mediating role accounting for 38.4% of the effect; and 3) On the regulatory mechanism of emotional alienation, it was found that psychological capital significantly moderated the relationship between digital education experience and emotional alienation.

Keywords: Digital Education, Emotional Alienation, Online Learning Burnout, Wuhan College of Arts and Sciences

1. Introduction

1.1 Background of Research

With the deepening of the global scientific and technological revolution and industrial transformation, digital technology has been deeply integrated into the field of education and plays a crucial role in reshaping the form of higher education. Digital education actively promotes the equity and efficiency of educational resources through diverse channels and has become a common priority strategy for educational development in most countries. In recent years, the Chinese government has attached great importance to the digital transformation of education, and the key role of digital education in promoting the high-quality development of national education and the cultivation of innovative talents has become increasingly prominent. The wide application of digital technology has not only broken the time and space barriers of traditional teaching but also comprehensively supported the construction of a modern education system. According to the *China Higher Education Digital Development Report (2024)*, China's colleges and universities have more than 15 million online course resources, and more than 98% of universities have achieved full digitalization of teaching management processes. This policy focus has further prompted educational administrative departments at all levels and universities to increase investment and construction in digital teaching systems.

Amid the wave of digital transformation, universities, as the core implementation field of digital education, are undergoing fundamental changes in their teaching models and students' learning ecology. As a representative private undergraduate college, Wuhan College of Arts and Sciences has actively promoted digital teaching reform in recent years and has built an "online-offline integrated" teaching system covering various intelligent platforms. The university is rich in digital teaching resources, with digital courses accounting for 62% of the total curriculum, covering all majors and grades across the campus. However, with the in-depth popularization of digital education, the implicit squeeze of its inherent "instrumental rationality" on educational "communicative rationality" has gradually emerged, and the imbalance of students' emotional ecology has become increasingly prominent. According to the recent mental health survey data of the university, up to 41.3% of students experience strong loneliness during online learning, and 58.7% of high-frequency participants who study online for more than 9 hours per week show obvious tendencies of emotional alienation.

College students are the direct audience and core participants of digital education, and their emotional state is directly related to the ultimate realization of the moral education goal of higher education. As a special group in a critical period of psychological development, college students exhibit unique psychological capital, coping mechanisms, and emotional experiences when facing a highly symbolic and decontextualized digital learning environment. In-depth exploration of college students' emotional alienation in the digital environment, as

well as mastery of its characteristics and evolution rules, is of great practical significance for scientifically evaluating the quality of digital teaching and implementing precise emotional education interventions. At present, although the academic community has initially paid attention to the emotional crisis caused by technological discipline, existing studies mostly conduct speculation from the macro-philosophical level, and few studies focus on the specific group of undergraduates in private colleges and systematically explore the interaction mechanism of multiple factors such as digital environment, teacher investment, and individual traits using empirical data. Based on the above background, this study focused on investigating the current characteristics and core influencing factors of emotional alienation among undergraduates at Wuhan College of Arts and Sciences in the context of digital education.

1.2 Purpose of Research

The primary goal of this study was to explore and clarify the current characteristics of emotional alienation among undergraduates at Wuhan College of Arts and Sciences in the digital education environment. Specifically, three consecutive objectives were set to guide this study. Firstly, through descriptive statistical analysis of the collected data, this study was aimed to identify the differential performance of emotional alienation on different demographic variables (such as gender, grade, major category, origin, etc.). Secondly, this study was aimed to deeply analyze the core mechanisms leading to college students' emotional alienation. The analysis focused on four core dimensions: "characteristics of digital education environment" (including digital learning load and platform interaction quality), "educator support" (teachers' emotional investment), and "individual traits" (positive psychological capital). Finally, this study would put forward targeted intervention and optimization strategies to provide scientific practical guidance to build an "emotion-connected" digital education ecosystem.

2. Literature Review and Related Research

2.1 Digital Education and Emotional Alienation

Emotional alienation in the context of digital education refers to the state of online learning burnout, social isolation, and emotional indifference exhibited by students in a technology-mediated learning environment due to the lack of real physical co-presence and in-depth emotional communication (Long, 2022). With the in-depth advancement of educational digital transformation, the academic community has continuously tracked the emotional status of college students in online learning. A study by Ran Bowen and Hou Yangyang (2025) pointed out that against the background of high-quality educational development, a teaching model overly reliant on online platforms tends to weaken the emotional connection between teachers and students, leading some students to develop significant feelings of loneliness and alienation

in digital space. Peng Bingbing and Zheng Jiayue (2025) further indicated when discussing the practical challenges of intelligent technology-enabled education that while technology improved the efficiency of knowledge transmission, it also brought an objective risk of "symbolization" of teaching interaction and weakened real interpersonal relationships. This concomitant technological alienation constitutes the direct realistic basis for college students' emotional alienation.

2.2 Influencing Factors and Relationships of Emotional Alienation

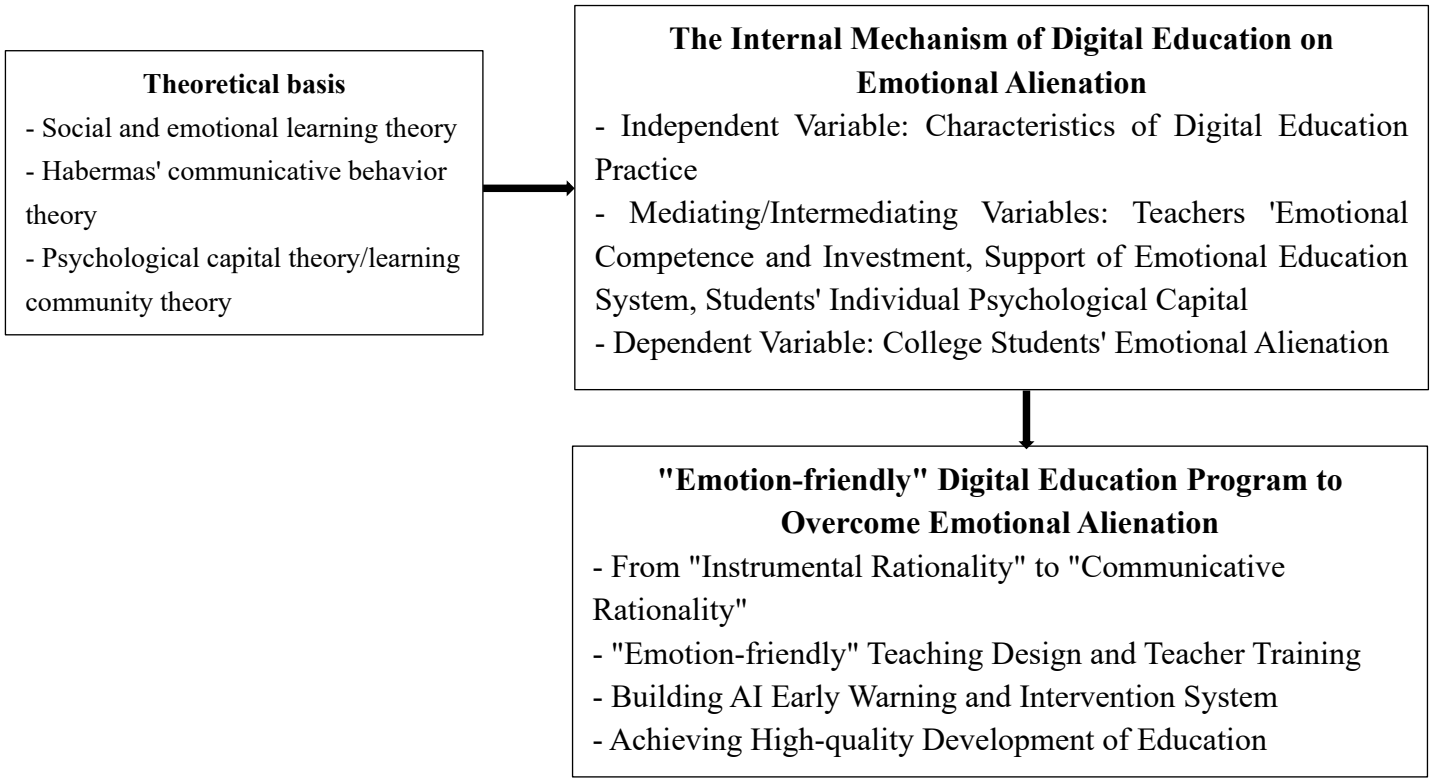
The generation and evolution of emotional alienation are subject to the interaction between the external digital education environment and individual internal traits. High-intensity digital learning load and low-quality platform interaction design are important external incentives inducing students' emotional exhaustion. In terms of coping mechanisms against external pressure, an empirical study by Zhang Kuo et al. (2010) confirmed that positive psychological capital (covering four dimensions: self-efficacy, resilience, optimism, and hope) was the core barrier for individuals to resist external environmental pressure. Abundant psychological capital could effectively buffer the impact of negative environments on individual mental health and learning status. In addition, educators' emotional intervention plays a key mediating role in alleviating alienation. Zheng Xuanbin (2025) argued that in the virtual classroom of the intelligent media era, teachers' "sense of presence" and emotional support were necessary conditions for reshaping the teacher-student interaction network and eliminating students' psychological isolation. Han Xiao (2024) also points out that intervention strategies based on emotional education could significantly stimulate students' internal learning motivation, thereby effectively reducing the burnout caused by disciplined digital learning.

2.3 Core Theory: Theory of Communicative Action

The core theoretical support of this study was Jürgen Habermas' "Theory of Communicative Action". This theory divides human rationality into "instrumental rationality" that pursues efficiency, calculation, and control, and "communicative rationality" that aims to achieve mutual understanding and consensus among subjects (Zhou, 2024). In the specific context of digital education, various digital teaching platforms often follow the underlying operational logic of instrumental rationality, simplifying the originally rich educational evaluation system into background quantitative data such as "click-through rate" and "video viewing duration". Zhou Zhenfan (2024) used this theory to analyze that this systematic technological logic has caused implicit colonization of the educational "life world", and reduced teacher-student interaction from warm "intersubjective" communication to cold one-dimensional information transmission and data discipline. The damage to communicative rationality and the rupture of intersubjectivity constitute the deep philosophical root of college students' emotional alienation

in the digital environment. This theoretical framework not only fully explains the internal logic of emotional crisis induced by digital technology but also provides solid theoretical support for this study to subsequently propose intervention strategies of "transcending instrumental rationality and returning to the authenticity of communication".

2.4 Variables and Conceptual Framework



3. Research Methodology

Mixed methods research was adopted in this study to systematically reveal the potential trends and mechanisms of emotional alienation. For the quantitative part, the main data collection tools were structured questionnaires distributed and collected through online platforms. In addition, a purposive sampling was adopted to select key informants as qualitative research samples for an in-depth interview to collect supplement information and support the explanation of deep-seated reasons.

3.1 Population and Sample

This study selected full-time undergraduates from 8 schools and 46 majors of Wuhan College of Arts and Sciences as the research population. A combination of stratified quota sampling and random sampling was adopted in the sampling stage. According to mathematical statistics principles, for a large-scale known population, at a 95% confidence level (Z=1.96), 5% allowable sampling error (E=0.05), and an estimated population variance ratio of 0.5 (p=0.5), the theoretical minimum sample size (n) calculated by the formula was approximately 384.

In practice, 390 valid quantitative questionnaire samples were finally collected and retained (n=390 > 384), fully meeting the accuracy and scientific requirements of sampling statistics. Meanwhile, purposive sampling was adopted to select 30 key informants (including 18 students, 8 teachers, and 4 counselors) as qualitative research samples for detailed interview.

3.2 Data Collection Technology

In the quantitative data collection stage, standardized digital questionnaires with QR codes and exclusive links were generated through "Questionnaire Star" and "Chaoxing Learning Pass" platforms and sent to the class learning groups of Wuhan College of Arts and Sciences. Participating undergraduates only needed to scan the QR code or click the link to directly enter the answering interface. The introduction of the questionnaire clearly stated the academic nature of the study and the principle of anonymity and confidentiality, guiding students to evaluate objectively based on their real online learning experience. All answering data were automatically recorded and summarized by the Questionnaire Star background system. Qualitative data were collected through semi-structured in-depth interviews combining online and offline methods, and full-text transcription of interview voices was conducted.

3.3 Data Processing and Analysis Technology

3.3.1 After the questionnaires were collected, data cleaning was first carried out to eliminate invalid questionnaires with extremely short answering time, regular answering, and missing information, and the valid data were structurally coded. Then the data were imported into professional statistical software for in-depth analysis.

3.3.2 Multiple statistical and analysis techniques were adopted in this study: For the quantitative part, SPSS 26.0 and AMOS 24.0 software were used to sequentially perform descriptive statistics, reliability and validity testing, common method bias testing, one-way ANOVA, Pearson correlation analysis, and structural equation modeling (SEM) path testing (including Bootstrap mediation and moderation effect testing). For the qualitative part, NVivo

12 software was used to extract nodes from interview texts through open, axial, and selective three-level coding techniques, and finally triangulation was achieved.

3.4 Research Instruments and Variables Used

This study employed a structured questionnaire as the core measurement tool, and the questionnaire variable design was divided into the following two modules:

(1) Demographic control variables: basic characteristic variables such as students' gender, grade, major category, and origin.

(2) Core latent variable measurement scales: including "College Students' Emotional Alienation Scale" (containing three sub-dimensions: online learning burnout, social alienation, and emotional indifference), "Digital Education Practice Experience Questionnaire" (containing digital load and platform interaction quality), "Teachers' Emotional Investment Perception Scale", and "Positive Psychological Capital Scale (PPQ)".

3.5 Reliability and Validity Testing

SPSS 26.0 software was used to test the reliability of the collected questionnaire data. Reliability testing was mainly based on Cronbach's alpha coefficient (α) and validity KMO value: when α is lower than 0.7, the questionnaire design is not ideal; when α is between 0.7 and 0.8, the questionnaire is acceptable; when α is between 0.8 and 0.9, the questionnaire design is ideal; when α is above 0.9, the questionnaire design is excellent. Statistical results showed that the α reliability coefficient of the core measurement tool "College Students' Emotional Alienation Scale" was 0.89, and the α coefficient of the "Digital Education Practice Experience Questionnaire" was 0.85. This fully indicated that the questionnaires used in this study had satisfactory reliability and high internal consistency of the data.

Validity testing was mainly evaluated based on Kaiser-Meyer-Olkin (KMO) measure and P-value (significance). Before conducting in-depth structural equation and factor analysis, "KMO and Bartlett's Test of Sphericity" must be carried out, and the specific test results were shown in Table 1.

Table 1 KMO and Bartlett's Test

Test Item	Index Name	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.892

Test Item	Index Name	Value
Bartlett's Test of Sphericity	Approx. Chi-Square	3421.512
	df	435
	Sig. / P-value	0.000

The KMO and Bartlett's test results in Table 1 indicated that the KMO value of this study (0.892) was higher than the excellent standard of 0.8, and the p-value of Bartlett's Test of Sphericity was 0.000 (less than the extremely significant level of 0.001). These indicated that there was a strong partial correlation between the measurement items of the questionnaire, the structural validity design of the questionnaire was effective, and the research findings could be fully used for subsequent factor analysis and empirical inference.

4. Research Results

4.1 Descriptive Statistics and Current Status Analysis of Emotional Alienation

Statistical analysis was conducted on the collected 390 valid questionnaire data to reveal the current characteristics, group differences, and the mechanism of core influencing factors of emotional alienation among undergraduates at Wuhan College of Arts and Sciences. Data processing and hypothesis testing were mainly completed by SPSS 26.0 and AMOS 24.0 software. To accurately measure the emotional state of college students in the digital education environment, descriptive statistical analysis was first carried out on the total emotional alienation scale and its three sub-dimensions. A 5-point scoring method was adopted for the scale, with higher values representing deeper alienation. The statistical results are shown in Table 2.

Table 2 Descriptive Statistics of College Students' Emotional Alienation and Its Dimensions

Variable Name	Mean (M)	Std. Deviation (SD)
Online Learning Burnout	3.42	0.72
Social Alienation	3.15	0.68
Emotional Indifference	2.97	0.75
Total Emotional Alienation	3.18	0.64

It can be seen from Table 2 that the total mean score of emotional alienation among students at Wuhan College of Arts and Sciences is 3.18 (SD=0.64), slightly higher than the

theoretical median of 3, indicating that this group generally has a moderately high level of emotional alienation in the context of digital education. In terms of specific dimensions, online learning burnout has the highest score (Mean=3.42), reflecting that students have obvious psychological exhaustion with highly disciplined digital learning tasks; social alienation is the second (Mean=3.15), showing a typical state of "digital gathering, psychological isolation".

There are significant differences in emotional alienation among college students of different grades. Independent sample t-test and one-way ANOVA were used to examine the significance of differences in emotional alienation by gender and grade, and the results are shown in Table 3.

Table 3 Differences in Emotional Alienation by Gender and Grade

Background Variable	Category	Sample Size (n)	Mean (M)	Std. Deviation (SD)	t/F value	p value
Gender	Male	182	3.24	0.61	1.68	0.093
	Female	208	3.13	0.66		
Grade	Freshman	98	2.85	0.58	4.12**	0.007
	Sophomore	102	3.35	0.62		
	Junior	105	3.42	0.69		
	Senior	85	3.10	0.63		

Note: 1. Independent sample t-test for gender and major category; one-way ANOVA for grade. 2. *p < 0.05, significant; **p < 0.01, highly significant.

In the gender difference, the statistical results show that the total emotional alienation score of male students (M=3.24) is slightly higher than that of female students (M=3.13), but the difference does not reach statistical significance (P > 0.05). This indicates that male and female students have similar feelings of emotional alienation under the pressure of digital education.

In the grade difference, one-way ANOVA shows that there are significant differences in emotional alienation among students of different grades (F=4.12, P < 0.01). Post-hoc test (LSD) shows that sophomore and junior stages are the high-incidence periods of emotional alienation. This reflects that the pressure of digital teaching shows the characteristics of diminishing marginal emotional effect after students pass the adaptation period (starting from sophomore year), and students have obvious aesthetic fatigue with repetitive digital interaction tasks. The emotional alienation scores of sophomores and juniors are significantly higher than

those of freshmen. It is analyzed that with the increase of digital learning time, the novelty brought by technology fades, while the task pressure driven by instrumental rationality gradually accumulates, leading to higher emotional burnout among senior students.

There are significant differences in emotional alienation between students majoring in humanities and social sciences and those majoring in science, engineering, economics, and management. Independent sample t-test and one-way ANOVA were used to examine the significance of differences in emotional alienation by major category and origin, and the results are shown in Table 4.

Table 4 Differences in Emotional Alienation by Major Category and Origin

Background Variable	Category	Sample Size (n)	Mean (M)	Std. Deviation (SD)	t/F value	p value
Major Category	Humanities & Social Sciences	175	3.02	0.59	-3.15*	0.012
	Science, Engineering, Economics & Management	215	3.28	0.67		
Origin	Urban	234	3.16	0.65	0.56	0.578
	Rural	156	3.21	0.62		

Note: 1. Independent sample t-test for origin; one-way ANOVA for major category. 2. *p < 0.05, significant; **p < 0.01, highly significant.

In the major category difference, it is found that the emotional alienation score of students majoring in science, engineering, economics, and management (M=3.28) is significantly higher than that of students majoring in humanities and social sciences (M=3.02, t=3.15, P < 0.05). This may be related to the nature of disciplines. Science and engineering courses focus more on logical calculation and standard answers, and the online teaching process often shows stronger "decontextualization" characteristics. Students are more likely to develop instrumental alienation in an environment lacking semantically rich interactions. There is relatively less humanistic care-based communication between teachers and students.

In the difference of origin and family background, the results show that students from urban and rural areas have relatively uniform score distribution in all dimensions of emotional alienation, without significant group differences.

The emotional alienation of students at Wuhan College of Arts and Sciences is mainly affected by learning stage (grade) and discipline attributes, and shows obvious characteristics

of "technology-led, emotion-deficient". This current situation provides an empirical basis for the subsequent analysis of the impact of digital education practice characteristics on emotional alienation.

To explore the correlation between online learning burnout and each dimension of emotional alienation, as well as the internal relationship between students' sense of experience in practical teaching activities and emotional alienation in the context of digital education, Pearson Product-Moment Correlation was used to statistically test the four core dimensions of digital education practice (platform interaction quality, digital learning load, teachers' emotional investment perception, and intelligent media technology application) with emotional alienation and its subordinate dimensions, as shown in Table 5.

refers to the Pearson Correlation Coefficient, the most commonly used indicator of the linear correlation between two variables. The r value can scientifically prove whether there is a correlation between "digital education experience" and "emotional alienation" and how strong the correlation is. The value range of r is -1 to +1: $r > 0$ (positive correlation) means the two variables change in the same direction. For example, digital learning load is positively correlated with emotional alienation ($r = 0.51$), meaning the heavier the learning load, the stronger the sense of emotional alienation. $r < 0$ (negative correlation) means the two variables change in opposite directions. For example, teachers' emotional investment is negatively correlated with emotional alienation ($r = -0.58$), meaning the more emotional investment from teachers, the lower the students' emotional alienation. $r = 0$ means no linear correlation between the two variables.

or ** in the upper right corner of the r value represents the p-value (significance level). $p < 0.01$: ** means 99% confidence that the two indicators are indeed correlated, and the result is highly reliable.

Table 5 Correlation between Digital Education Practice and Emotional Alienation

Indicator	Total Emotional Alienation	Online Learning Burnout	Social Alienation	Emotional Indifference
Platform Interaction Quality	-0.42**	-0.38**	-0.45**	-0.21*
Digital Learning Load	0.51**	0.62**	0.35**	0.18*
Teachers' Emotional Investment	-0.58**	-0.49**	-0.52**	-0.55**
Intelligent Media Technology Application	-0.12	-0.08	-0.15	-0.05

Note: *p < 0.05; **p < 0.01.

There are significant correlations between various experience indicators of digital education practice and college students' emotional alienation. In terms of platform interaction quality and emotional alienation, the data show that platform interaction quality is significantly negatively correlated with the total score of emotional alienation ($r=-0.42$, $p < 0.01$). This indicates that the more humanized and immediate the interactive design of the digital teaching platform, the lower the students' emotional alienation. Especially in the dimension of social alienation, good platform interaction can significantly enhance students' sense of belonging. In terms of digital learning load and emotional alienation, digital learning load is significantly positively correlated with the total score of emotional alienation and the dimension of online learning burnout ($r=0.51$, $p < 0.01$). This indicates that when teaching tasks are overly dependent on digital forms and the total amount is too large, students are prone to emotional exhaustion, which in turn induces alienation psychology. In terms of teachers' emotional investment perception and emotional alienation, teachers' emotional investment perception shows a strong negative correlation with all dimensions of emotional alienation ($r =-0.58$, $p < 0.01$). Among them, teachers' "true feelings, sincerity, and authenticity" investment in the digital environment has the most obvious inhibitory effect on alleviating emotional indifference. In terms of intelligent media technology application and emotional alienation, the study finds that intelligent media technology application (such as AI-assisted teaching) has a weak or insignificant correlation with emotional alienation. This may imply that technology itself is "neutral", and its impact depends on how technology serves the substantive interaction between teachers and students.

Based on the correlation analysis, the following preliminary conclusions can be drawn: Firstly, the quality of "human-computer interaction" cannot replace the quality of "human-human interaction". Although platform interaction can alleviate part of the alienation, its correlation coefficient is absolutely lower than that of teachers' emotional investment. This confirms the viewpoint of Habermas' Theory of Communicative Action in Chapter 2: in digital education, "communicative rationality" based on language and emotional understanding is the core to solving alienation. Secondly, digital learning burden is the main inducement of burnout. In the actual teaching of Wuhan College of Arts and Sciences, the flood of digital forms (such as excessive check-in and lengthy video viewing tasks) significantly increases students' online learning burnout. This burden caused by "technological compulsion" alienates the learning process into a task-completion process, affecting students' emotional communication with knowledge. Finally, teachers' emotional "presence" plays a key buffering role. Teachers' emotional investment has the strongest negative correlation with emotional alienation, which means that in the context of digital education, teachers should not be just resource providers but emotional connectors. When students can feel teachers' attention and warmth, the "spatial barrier" brought by digital technology will be effectively bridged, thereby reducing the risk of social alienation and emotional alienation.

Students specifically exhibit behavioral characteristics of "social isolation" and "avoidance of reality" in digital learning (see Table 6). This table is compiled based on the recovered content of open-ended questions in the fourth part of the questionnaire. Typical cases described by students such as "digital gathering, psychological isolation" are extracted as qualitative evidence for quantitative data.

Table 6 Qualitative Coding Summary of Students' Specific Manifestations of Emotional Alienation

Core Category	Behavioral Characteristics	Typical Interview/Questionnaire Quotes	Frequency (N=390)	Percentage (%)
Sense of Social Isolation	Island Effect in Digital Gathering	"Even though everyone is sending messages in the group, I still feel like I'm alone facing the screen and can't feel the existence of classmates."	156	40%
	Lack of Belonging	"I always feel like watching a movie in online classes, an outsider, and it's hard to develop a sense of collective honor."	128	32.8%

Core Category	Behavioral Characteristics	Typical Interview/Questionnaire Quotes	Frequency (N=390)	Percentage (%)
Avoidance of Reality	Elevated Social Threshold	"I'm used to being alone after digital learning, and I feel tired when dining with classmates in reality, preferring to stay in 'online solitude'."	112	28.7%
	Sluggish Real-Life Communication	"I'm used to using emojis and bullet screens, and I don't know what to say when communicating face-to-face in reality, even avoiding eye contact subconsciously."	95	24.4%
Alienation of Psychological Dependence	Compensatory Digital Addiction	"I can only relieve that loneliness by frantically scrolling short videos because of high study pressure and no one to talk to."	143	36.7%
	Weakening of Real Interpersonal Relationships	"I feel the relationship with roommates in reality has become distant. Everyone plays with their mobile phones when returning to the dormitory, and the psychological distance is getting farther and farther."	134	34.4%

In summary, the research objectives are empirically supported. Students at the university generally have a moderate level of emotional alienation accompanied by significant online learning burnout. In particular, the significant differences exhibited by students majoring in science, engineering, economics, management and senior students reveal the group imbalance of emotional characteristics in the digital environment, which lays a foundation for the subsequent exploration of influencing paths.

4.2 Influencing Factors and Path Analysis of Emotional Alienation in the Context of Digital Education

The influencing paths of digital education characteristics, individual traits, and environmental support on emotional alienation are deeply discussed. Through multi-dimensional factor correlation analysis, this paper aims to identify the key factors inducing alienation and reveal the regulatory and mediating mechanisms of environmental factors such as teachers' emotional investment. Digital education characteristics (learning load and platform

interaction) significantly affect students' emotional alienation level.

Table 7 Pearson Correlation between Digital Education Characteristics and Emotional Alienation

Dimension Indicator	Total Emotional Alienation	Online Learning Burnout	Social Alienation	Emotional Indifference
Digital Learning Load	0.51**	0.62**	0.35**	0.18*
Platform Interaction Quality	-0.42**	-0.38**	-0.45**	-0.21*

Note: *p < 0.05, **p < 0.01.

Based on statistics of Questions 1-3 (platform interaction) and Question 5 (learning duration/load) in the questionnaire. The statistical results show that digital learning load is significantly positively correlated with the total score of emotional alienation and online learning burnout (r=0.51, p < 0.01). This proves that excessive task load is the core external incentive inducing students' sense of alienation. On the contrary, platform interaction quality is significantly negatively correlated with alienation (r=-0.42), indicating that humanized interactive design can effectively alleviate the "digital island" phenomenon.

As a key environmental support factor, teachers' emotional investment has an obvious effect on alleviating students' emotional alienation.

Table 8 Regression Analysis of Teachers' Emotional Investment Perception on Emotional Alienation

Predictor	Standardized Regression Coefficient (β)	t value	p value	Explanatory Power (R^2)
Teachers' Emotional Investment	-0.58	-9.24	<0.001	0.34

The research objective proposes the mechanism of environmental support factors such as teachers' emotional investment regulating emotional alienation. Based on Questions 9-11 in the questionnaire, the analysis shows that teachers' emotional investment perception has a significant negative predictive effect on emotional alienation (β= -0.58, p < 0.001). This means that teachers' "true feelings, sincerity, and authenticity" investment in the digital environment is the most effective "protective factor" to alleviate students' emotional indifference.

Students' individual traits (psychological capital) play a buffering role between digital

experience and emotional alienation. To further analyze the moderating effect of psychological capital in the relationship between digital education practice experience and emotional alienation, and realize the buffering mechanism of individuals in the process of emotional alienation generation, the moderating effect of students' psychological capital on the path from "digital education practice" to "emotional alienation" was examined.

Table 9 Test of the Moderating Effect of Psychological Capital between Digital Education Experience and Emotional Alienation

Model Step	Predictor	β	t value	p value
Step 1	Digital Education Practice Experience	0.45	8.32	<0.001
Step 2	Psychological Capital	-0.32	-5.18	<0.001
Step 3	Interaction Term (Digital Experience × Psychological Capital)	-0.21	-3.45	<0.05

The interaction analysis was conducted by centralizing the indicators and regressing the product term of digital education practice experience and psychological capital into the model. Statistical analysis shows that the interaction term has a significant predictive effect on emotional alienation (β=-0.21, $p < 0.05$), indicating that psychological capital plays a significant moderating role in the relationship. That is, the negative impact of digital education on emotional alienation varies with the level of individual psychological capital. Students with high psychological capital (such as optimism and resilience) show significantly lower levels of emotional alienation when facing the same degree of digital pressure (simple slope = 0.24).

The current digital education environment has dilemmas such as "vague goals and single form" in emotional support.

Table 10 Content Analysis Summary of the Dilemma of Lack of Emotional Care in Digital Education

Dilemma Category	Core Performance Description (Coding)	Frequency (n=390)	Percentage (%)
Simplification of Form	Emotional communication is limited to emojis, quick replies, or bullet screens, lacking in-depth communication.	185	47.4%
Vagueness of Goal	Teaching focus is overly biased towards "click-through rate" and "video viewing duration", ignoring emotional resonance.	168	43.1%

Dilemma Category	Core Performance Description (Coding)	Frequency (n=390)	Percentage (%)
Lag of Feedback	Delayed teacher responses in asynchronous teaching, unable to provide immediate emotional support.	142	36.4%

Based on text coding statistics of open-ended questions (Questions 30-31) in the questionnaire, qualitative evidence for the "current dilemma of emotional education" required by the research objectives. The data clearly reflects the encroachment of "instrumental rationality" on "communicative rationality" in the current education model. Nearly 50% of students believe that digital interaction is only superficial and cannot carry deep emotional value, which directly verifies the practical dilemma of single form and alienated goals of emotional education proposed in the research objectives.

This study systematically identifies the core factors affecting emotional alienation of students at Wuhan College of Arts and Sciences and their action paths through quantitative models and qualitative coding. The empirical analysis of influencing factors and mechanisms of emotional alienation in the context of digital education identifies the key external incentives inducing emotional alienation: 1. Data confirms that digital learning load is significantly positively correlated with emotional alienation, indicating that excessive digital tasks are the main cause of students' online learning burnout and psychological isolation. 2. The significant negative predictive effect of environmental support factors is established. Teachers' emotional investment perception has a strong negative correlation with emotional alienation, and path analysis shows that its direct explanatory power reaches 34%, making it the core "protective factor" to alleviate students' emotional indifference. 3. The mediating effect path of teachers' emotional investment is revealed: structural equation modeling shows that teachers' emotional investment plays a partial mediating role between digital education practice and emotional alienation, that is, the impact of digital education on students' emotional state is realized through the quality of emotional interaction between teachers and students. 4. The regulatory mechanism of individual traits on technological pressure is confirmed: psychological capital plays a significant moderating role in the relationship between digital experience and emotional alienation. High psychological capital can effectively buffer the technological pressure brought by the digital environment and reduce the level of emotional alienation under high load. 5. The practical dilemmas of single form and vague goals of current emotional education are analyzed. Qualitative research finds that 47.4% of students believe that digital interaction is only at the symbolic stage, lacking in-depth emotional communication. The expansion of "instrumental rationality" leads to the "de-lifeization" of the educational process and the lack of intersubjectivity. Through the above analysis, this study breaks through the limitations of

univariate analysis and constructs a multi-dimensional influence model covering "technological characteristics—individual traits—environmental support", providing an empirical basis for the next step of proposing optimization strategies.

4.3 Empirical Path and Mechanistic Basis for Constructing an Emotion-Connected Support Program

Based on the mediating path of teachers' emotional investment, it is necessary to accurately design an "emotion-connected" digital teaching intervention plan. On the basis of confirming significant correlations between indicators, AMOS 24.0 software was used to construct a structural equation model (SEM) to conduct in-depth tests on the core paths in the research hypotheses. The key discussion is the role of teachers' emotional investment in the relationship between digital education practice and emotional alienation, as well as the moderating effect of students' psychological capital.

Table 11 Support for the Strategy of "Improving Teachers' Emotional Competence"

Path Relationship	Path Coefficient (β)	Standard Error (SE)	t value	p value	Conclusion
Digital Education Practice → Emotional Alienation (Total Effect)	0.45	0.08	8.32	<0.001	Established
Digital Education Experience → Emotional Alienation	0.28	0.05	5.60	<0.01	Established
Digital Education Practice → Teachers' Emotional Investment	-0.36	0.07	-5.14	<0.01	Established
Teachers' Emotional Investment → Emotional Alienation	-0.48	0.06	-7.26	<0.001	Established
Indirect Effect of Teachers' Bridge	0.17	/	/	/	Partially Significant

Note: 1. The data in the table are estimated values of structural equation model (SEM) based on 390 samples; 2. Participation calculation formula: (A×B) / C = ((-0.36)×(-0.48)) /

0.45≈38.4%.

The empirical data results provide a direct basis for the strategy of improving teachers' emotional competence proposed in the research objectives. The indirect effect value of teachers' emotional investment between digital education practice and emotional alienation is 0.17, with a contribution rate of 38.4% to alleviating alienation. The optimization plan should transform teachers from simple "knowledge transmitters" to "emotion connectors". By adding functions such as online course comments and online replies on digital platforms, emotional encouragement and demand research (as shown in dimensions 9-11 of the questionnaire), the "frequency of teacher-student emotional interaction" should be included in the digital teaching quality evaluation system to ensure the balance between technological efficiency and emotional care and block the alienation path caused by technological alienation.

The bias-corrected non-parametric percentile Bootstrap method was used to test the mediating effect of teachers' emotional investment. The model takes digital education practice experience as the independent variable, teachers' emotional investment as the mediating variable, and emotional alienation as the dependent variable.

The solution results of path coefficients show that the total effect path coefficient of digital education practice experience on emotional alienation is $\beta = 0.45$ ($p < 0.001$). After including the mediating variable, the direct predictive coefficient of digital education practice experience on emotional alienation drops to $\beta = 0.28$ ($p < 0.01$), but it is still statistically significant. Meanwhile, the internal path shows that digital education practice experience significantly negatively predicts teachers' emotional investment ($\beta = -0.36$, $p < 0.01$), and teachers' emotional investment has an extremely significant negative predictive effect on emotional alienation ($\beta = -0.48$, $p < 0.001$).

Bootstrap test results further show that the indirect (mediating) effect value of teachers' emotional investment is 0.17, with a 95% confidence interval of [0.085, 0.294]. Since the confidence interval does not contain 0, it confirms that teachers' emotional investment plays a significant partial mediating role between digital education practice experience and emotional alienation. This means that 38.4% of the impact of digital education practice on students' emotional state is realized by affecting the quality of emotional interaction between teachers and students.

Based on the analysis results shown in Table 11, this study believes that optimizing teachers' emotional competence is the primary path to construct an "emotion-connected" digital education model. Empirical data show that teachers' emotional investment plays a key bridging role in alleviating the impact of technological alienation, with a contribution rate of nearly 40%. Therefore, in specific practical guidance programs, "teachers' emotional empowerment"

must be placed at the core. This requires the school to institutionalize teachers to carry out active emotional intervention by using the functional dimensions of digital platforms when improving online interaction design, so as to effectively hedge the emotional barriers brought by the digital teaching system by strengthening intersubjective communication between teachers and students, ensuring that higher education does not lose humanistic care while improving efficiency.

Based on the distribution of the moderating effect of psychological capital, a classified early warning and support program for high-risk groups of emotional alienation is constructed.

Table 12 Test of the Moderating Effect of Students' Psychological Capital

Moderator Level (Psychological Capital)	Simple Slope	Standard Error (SE)	t value	p value
Low Psychological Capital Group (M-1SD)	0.52	0.06	8.67	<0.001
High Psychological Capital Group (M+1SD)	0.24	0.05	4.80	<0.01

Simple Slope Analysis: To further describe the specific performance of the moderating effect, the study plotted the moderating effect graph according to the level of psychological capital scores (plus or minus one standard deviation). For students with low psychological capital, the positive predictive effect of digital education practice experience on emotional alienation is significant (simple slope= 0.52, $p < 0.001$), indicating that students with weak psychological quality are more sensitive to technological pressure and social barriers in the digital environment and lack effective self-regulation mechanisms. For students with high psychological capital, the predictive effect is significantly reduced (simple slope= 0.24, $p < 0.01$). This shows that students with high levels of psychological capital (such as optimism, resilience, and sense of efficacy) can better view the technological pressure and emotional disconnection brought by the digital environment, thus showing a lower level of emotional alienation under the same degree of digital burden.

Given the significant difference in simple slopes shown in Table 12, the establishment of a high-risk early warning mechanism should prioritize covering students with low psychological capital, and hedge the negative impact of technological alienation through targeted intervention of individual traits. The data results clearly show the imbalance of the "protective effect": students with low psychological capital have a much faster growth rate of emotional alienation than those with high levels when facing digital pressure. This empirical basis directly points to the logic of early warning mechanism construction proposed in the

research objectives. Psychological capital indicators such as students' psychological resilience and optimism should be included in the digital learning risk assessment system. By identifying and focusing on supporting low psychological capital groups, carrying out targeted psychological adjustment activities and motivation stimulation paths, students' internal psychological capital foundation can be consolidated from the internal trait level, providing scientific classified intervention criteria for the high-quality balance of digital education.

5. Conclusion, Discussion and Recommendations

5.1 Conclusion

This study takes 390 undergraduates from Wuhan College of Arts and Sciences as samples and adopts a mixed research method to deeply explore the characteristics and causes of college students' emotional alienation in the context of digital education, drawing the following main conclusions:

Firstly, college students' emotional alienation in the digital education environment is at a moderately high level (mean 3.18), with online learning burnout being particularly serious. In terms of group differences, sophomores, juniors, and students majoring in science, engineering, economics, and management are high-incidence groups of emotional alienation. Secondly, the characteristics of the digital education environment have a significant direct predictive effect on emotional alienation. High-intensity digital learning load is a positive incentive to aggravate alienation, while high-quality platform interaction design can effectively play a negative inhibitory role. Finally, in the internal path of the influencing mechanism, teachers' emotional investment plays a key partial mediating role (mediation contribution rate reaches 38.4%); meanwhile, positive psychological capital plays a significant negative regulatory and buffering role in the process of technological pressure transmission to emotional alienation, and the deterioration rate of alienation of students with low psychological capital is much higher than that of students with high psychological capital.

5.2 Discussion

The empirical findings of this study provide strong data support for the application of Jürgen Habermas' "Theory of Communicative Action" in the field of digital education. The study confirms that the digital teaching system is not a value-neutral tool. When teaching platforms excessively pursue background quantitative indicators such as "click-through rate" and "online duration", the "instrumental rationality" contained in the technical system will deeply encroach on the "communicative rationality" of educational authenticity. Under such discipline, students' intersubjective communication is reduced to one-dimensional human-

computer interaction, leading to serious social isolation and emotional indifference.

However, the establishment of mediating and moderating effects also indicates that technological alienation is not an irreversible one-way determinism. Teachers' emotional investment (as the core link in the educational life world) and students' psychological capital (as the internal resource for individuals to resist alienation) can effectively rebuild "intersubjectivity" in the digital divide. This enlightens that the digital transformation of higher education should not only stay in the upgrading of hardware and algorithms, but also seek a dynamic ecological balance between technological empowerment and humanistic scale.

5.3 Recommendations

Based on the above conclusions and discussions, the following three targeted optimization suggestions are put forward to effectively alleviate college students' emotional alienation in the digital environment:

(1) Reconstruct platform space and optimize the interactive affordability of digital education. In view of the main effects of digital load and interaction quality, universities need to change the single evaluation system that only focuses on background data. In the construction of digital teaching platforms (such as Chaoxing Learning Pass), more humanized emotional interaction design should be integrated. By adding high-fidelity synchronous communication, online peer support communities, and instant feedback mechanisms, the original mechanical "human-computer interface" will be upgraded to an "immersive emotional field" with high social presence.

(2) Empower the teaching team and improve teachers' digital emotional competence. In view of the 38.4% mediating contribution rate of teachers' emotional investment, universities must promote the transformation of teachers' roles from "system operators" to "emotion connectors". It is recommended to include "online emotional support and feedback ability" into the teacher professional development and teaching quality evaluation system, guide teachers to sensitively capture students' psychological anchoring needs in the virtual space, and break technical barriers with warm teaching interactions.

(3) Establish an early warning mechanism and implement hierarchical intervention based on psychological capital. In view of the extremely high vulnerability of students with low psychological capital when facing digital pressure (slope difference), universities should realize the in-depth linkage between mental health centers and digital teaching systems. Especially for high-risk groups such as sophomores, juniors, and students majoring in science, engineering, economics, and management, a "high-risk early warning mechanism for emotional alienation" should be established based on big data of learning behavior trajectories.

Through normalized resilience training and psychological support intervention, students' internal psychological capital foundation will be consolidated to achieve internal defense and regulation.

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