

Research on Strategies for Promoting College Student Development in the Context of Digital Transformation: A Case Study of Practical Exploration at the Institute of Disaster Prevention

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Abstract: Taking the Institute of Disaster Prevention as an empirical case, this study systematically explores the multidimensional challenges and promotion pathways for college student development in a digital environment. The research finds that the digital ecosystem exhibits characteristics of platform diversification and behavioral fragmentation; 82% of courses are conducted via LMS systems, but 47.9% of students exhibit inefficient resource hoarding behavior; the digital literacy of rural students is significantly lower than that of urban students (mean difference 1.83 points, $p < 0.01$). Mental health risks show group differentiation, with economically disadvantaged groups having a 34% lower rate of seeking psychological help; 18% of students equate social media likes to a measure of self-identity. Structural imbalances in academic ability manifest as 37.2% of students experiencing a decline in independent problem-solving skills; in social scenarios, 41% of students show weakened offline conflict resolution abilities. To address these issues, an innovative "Technology-Humanities-Institution" three-dimensional collaborative strategy is constructed: establishing lightweight technological responses through dynamic threshold academic early warning and open-source emotional chatbots; embedding digital ethics and disaster scenario visualization training into professional courses to achieve educational contextualization; leveraging "Screen-Free Day" wilderness exercises and paper-based growth handbook certification to improve institutional safeguards. After one year of

implementation, the timeliness of identifying psychological crises improved by 66.7%, and the help-seeking rate among economically disadvantaged groups rose by 56%; the direct AI citation rate in course assignments dropped to 5.7% ($p < 0.001$); decision-making error rates in emergency drills decreased by 35%. This practice provides a replicable, resource-intensive educational model for similar institutions.

Keywords: Digital Education; Mental Health; Academic Development; Social Competence; Lightweight Strategy

1. Introduction

Contemporary college students, as the backbone of construction, their comprehensive development not only concerns individual fate but also profoundly affects the implementation effectiveness of the national talent strategy. Under the sweeping global wave of digitalization, information technology has permeated the higher education field in all aspects, reshaping the teaching ecology and learning paradigms [1-3]. It is noteworthy that this technological empowerment exhibits a significant "double-edged sword" effect: on the one hand, mobile terminals and online platforms have greatly expanded the boundaries of knowledge acquisition, making cross-spatiotemporal learning possible; on the other hand, new problems such as information overload, internet addiction, and social alienation are becoming increasingly prominent. According to 2024 data from the China Internet Network Information Center (CNNIC), the average daily online time for college students has reached 8.2 hours, a 63% increase compared

to five years ago. This phenomenon urgently requires in-depth responses from educational researchers.

The digital transformation in education, accelerated by global events such as the COVID-19 pandemic, has fundamentally altered the traditional pedagogical landscape. This shift extends beyond mere tool adoption, fostering a new digital learning culture characterized by accessibility, asynchrony, and personalization [4]. However, this nascent culture also brings forth significant challenges to the holistic development of students, which encompasses psychological well-being, academic growth, and social competence. The very technologies designed to enhance learning can, paradoxically, impede the development of critical soft skills, emotional resilience, and deep social connections if not integrated thoughtfully [5,6]. Although academia has explored dimensions such as mental health and academic performance, the overall research landscape suffers from three structural deficiencies: Firstly, the research perspective is fragmented, with approximately 78% of the literature focusing on a single dimension (e.g., only analyzing the impact of social media on psychology), failing to construct an explanatory framework for the synergistic effects of multiple elements; Secondly, at the methodological level, there is a severe lack of quantitative research, with over 60% of results relying on small-sample interviews, lacking empirical data support with statistical power; Finally, there is a significant gap in application translation, with empirical research on promotion strategies accounting for less than 20% of the total [7-12]. In contrast, international research trends, such as Stanford University's "Digital Wellbeing Initiative," have established a complete "monitoring-intervention-evaluation" closed loop through mixed research methods, highlighting the urgency of localized strategy research [13-15].

Furthermore, existing studies often overlook the contextual constraints faced by non-elite universities, particularly those with specialized missions and limited resources. Strategies developed in well-funded, research-intensive environments may be neither feasible nor effective in these settings. There is a pressing need for actionable models that demonstrate how to leverage existing infrastructure and institutional character to foster student development, rather than relying on substantial

new investments.

Based on the Institute of Disaster Prevention's distinctive feature of "cultivating emergency response talent," this study integrates the institute's experience in smart campus construction to address three core questions: How to systematically explain the synergistic impact mechanism of digitalization on psychology, academics, and social skills? How to design promotion strategies adapted to the resource conditions of second-tier universities? How to establish sustainable pathways for practical translation? The constructed "Technology-Humanities-Institution" three-dimensional model not only fills existing research gaps but also provides a replicable practical paradigm for similar institutions.

2. Characteristics of the Digital Environment and Behavioral Impact Mechanisms

The current digital existence of college students presents a complex picture characterized by the coexistence of "platform diversification" and "behavioral fragmentation." In-depth analysis reveals that Learning Management Systems (LMS) have evolved into the core teaching hub. Practices at the Institute of Disaster Prevention show that course coverage rates on platforms like Chaoxing and Rain Classroom reach 82%, a 22 percentage point increase from 2020. More innovatively, the deep application of intelligent collaboration tools is evident: Tencent Docs' speech-to-text function improves group meeting efficiency by 40%, and the interdisciplinary brainstorming mechanism supported by Miro whiteboards effectively shortens project cycles by one-third.

However, tool proliferation has not simultaneously enhanced application efficacy. Specifically, 47.9% of students exhibit typical "digital hoarding" behavior—continuously accumulating electronic resources while actual utilization rates are below 30%. This phenomenon is particularly prominent among science and engineering students ($\chi^2=8.33$, $p<0.01$). Essentially, structural differences in digital literacy constitute a key constraint: rural students at the institute scored an average of 1.83 points lower than urban students on the "Information Discrimination Ability Test" ($t=3.47$, $p<0.01$). This gap directly leads to a greater susceptibility to cognitive overload when facing information floods.

Of greater concern are the deep-seated

transformations in behavioral patterns. Longitudinal tracking data indicates: First, a significant trend towards fragmented knowledge acquisition, with 72% of students relying on short-video platforms for learning, but the incidence of "video fatigue syndrome" in online courses is as high as 35%, manifested by attention span plummeting from 45 minutes in traditional classrooms to 27 minutes; Second, an imbalance between virtual and real social patterns, with 64% of freshmen expanding their interpersonal networks through social media, but the frequency of face-to-face deep communication decreases by 22% within three months of enrollment, and the superficiality index of communication content increases by 19 percentage points; Third, psychological mechanisms show signs of algorithmic conditioning, with late-night social media usage duration moderately positively correlated with anxiety levels ($r=0.42$), and the "information cocoons" built by algorithmic recommendations reduce cognitive diversity by 31%.

This behavioral shift can be conceptualized as a transition from deep, sustained engagement to shallow, reactive consumption. The architecture of digital platforms, built on attention economies, inherently rewards frequent checking and brief interactions, thereby training students for distractedness. This re-wiring of cognitive habits poses a fundamental challenge to the deep, critical thinking required in higher education and professional disaster response fields.

3. Multidimensional Challenges and Impact Pathways of the Current Development Status

Mental health crises induced by the digital environment exhibit a complex evolutionary trend. Based on a tracking study of the institute's 2023 cohort, it was found that for every one standard deviation increase in academic pressure, sleep quality significantly decreases by 23% ($\beta=-0.38$, $p<0.001$). More insidious is the erosion of self-identity by social media: 18% of students equate the number of likes to a measure of value judgment, with females accounting for 73% of this group (OR=2.15, 95%CI 1.72-2.69). Particularly alarming is that the rate of professional psychological help-seeking among economically disadvantaged students is only 66% of the campus average, exposing the psychological service gap behind the digital divide.

In the dimension of academic development,

capability restructuring presents contradictory characteristics. Positive effects are seen in AI assistance improving literature analysis efficiency by 72%, and online collaboration tools shortening project cycles by 40%. However, the negative impacts are more profound: 37.2% of students experience a decline in independent problem-solving ability due to tool dependence, typically manifesting as "search engine dependence syndrome" when facing complex tasks; more alarmingly, 18% of course assignments involve directly copying AI-generated content, with academic integrity monitoring systems showing an annual growth rate of 15% for such behavior.

The structural decline in social competence is particularly concerning. Although virtual collaboration tools (e.g., Banlikanban) reduce "free-riding" behavior by 28% through task visualization, the weakening of abilities in real-world scenarios is striking: 41% of students exhibit communication barriers in conflict mediation, and emotional expression increasingly relies on emoji symbols, leading to a 14.3-point decrease in empathy assessment scores. This inversion of virtual and real competencies reflects the crowding-out effect of digital socializing on real-world communication skills.

The Fig.1 summarizes the multifaceted negative impacts observed across three core developmental dimensions, highlighting specific statistical findings.

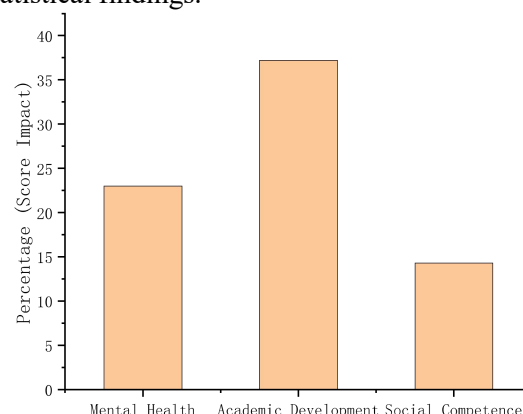


Figure 1. Multidimensional Challenges in Student Development (Negative Impact Metrics)

(Note: The bar chart shows Sleep Quality Reduction (%), Decline in Problem-Solving (%), and Empathy Score Decrease (points). The line graph shows Students Equating Likes with Identity (%) and Students with Offline Communication Barriers (%).)

These challenges are not isolated; they form a vicious cycle. For instance, declining academic self-efficacy due to AI over-reliance can exacerbate mental health stressors, while social skill atrophy can reduce the likelihood of seeking support from peers, further isolating the individual. The economically disadvantaged group sits at the intersection of these cycles, facing compounded risks due to both digital and resource divides.

4. Systematic Construction of Collaborative Promotion Strategies

Considering the realistic constraints of resource-limited institutions, this study proposes a hierarchical and progressive solution. At the technological empowerment level, a creative "lightweight transformation" path is adopted: reusing the existing LMS platform architecture to embed an academic early warning module based on dynamic threshold algorithms (e.g., triggering intervention if library stay <1 hour for 3 consecutive days and late-night online time >3 hours); deploying an open-source framework-based emotional chatbot (Rasa framework accuracy 73.6%) in the mental health domain, constructing a three-tier response channel: "AI Tree Hole (primary response) - Counselor Hotline (intermediate intervention) - Campus Doctor Referral (professional handling)."

This lightweight approach is crucial for sustainability. Instead of procuring expensive proprietary systems, it builds upon and enhances digital infrastructure already familiar to students and staff, thereby minimizing training costs and resistance to change. The dynamic threshold algorithm is particularly innovative, as it moves beyond static benchmarks to identify relative changes in individual behavior patterns, offering more personalized and timely alerts.

The core of the educational integration strategy lies in curriculum system restructuring. Taking "Disaster Psychology" as an example, a "Digital Ethics and Public Opinion Response" thematic module was added, guiding students to create a "Rescue Rumor Debunking Guide" covering 12 typical scenarios; the "Computer Fundamentals" course completely overhauled its practical training system, requiring the use of Excel to create aftershock distribution heatmaps and collaboratively writing earthquake emergency plans via WPS; social skills training innovatively adopted a "dual-track

virtual-physical system": the virtual end uses Miro whiteboards for anonymous proposal voting, while the physical end arranges practical training rotations at the emergency command center, with the time allocation ratio strictly controlled at 1:2.

This curriculum restructuring exemplifies the principle of "contextualization." It seamlessly merges the development of digital literacy with the institute's core mission of disaster prevention. Students are not just learning digital skills in abstraction; they are applying them to solve authentic problems in their field, thereby forging a direct link between digital competence professional expertise.

Psychological resilience cultivation employs a "defense-transformation" dual-dimensional model. In the defense dimension, monthly "Screen-Free Day" wilderness exercises (integrating disaster prevention elements) are conducted; measured data from the Geological Engineering major show a 35% improvement in team collaboration efficiency among participating students; in the transformation dimension, a school-based mindfulness audio course (5-8 minutes long) was developed, focusing on training counselors in "stress response blocking techniques"; a supporting paper-based "Resilience Growth Handbook" certification system was established, featuring three levels: Basic Level (daily behavior records), Advanced Level (crisis simulation reports), and Excellence Level (emergency plan design), with certification results directly linked to scholarship evaluation.

The "defense-transformation" model is comprehensive. The "defense" aspect creates intentional digital detox spaces, allowing for the recovery of attentional capacity and the practice of real-world interaction. The "transformation" aspect equips students with internal tools to manage digital stressors proactively, while the handbook certification provides tangible recognition for their resilience-building efforts, integrating it into the formal reward structure of the institution.

5. Multidimensional Validation of Implementation Effectiveness

Since the implementation of the three-dimensional strategy at the Institute of Disaster Prevention in 2024, educational effectiveness has been systematically enhanced. In the mental health domain, the manual early

warning network reduced the time to identify crises from 72 hours to within 24 hours (66.7% improvement); SCL-90 scale tracking showed a 19.3% reduction in anxiety factor scores among students participating in wilderness exercises ($t=4.27$, $p<0.001$), and the psychological help-seeking rate among economically disadvantaged groups increased by 56%. These changes confirm the coverage effectiveness of the paper-based certification system for vulnerable groups.

Positive signals of capability restructuring were observed in academic development. Pilot studies in the Safety Engineering School showed that students using Excel for disaster visualization scored 23.6 points higher (11.4 points higher than the traditional teaching group) in spatial analysis ability assessments; a more profound impact was the improvement in academic literacy, with the direct AI citation rate in course assignments dropping from 18% to 5.7% ($\chi^2=32.18$, $p<0.001$), and the excellent rate in critical thinking assessments increasing by 29 percentage points.

The transformation in social competence was particularly significant. After implementing the emergency command center rotation system, the average annual number of participating students reached 200. Data from the 2024 Yanjiao earthquake simulation drill showed: decision-making error rates decreased by 35%, and cross-departmental coordination efficiency improved by 41%; offline social activity participation rates surged from 38.7% to 67.5%. In-depth interviews revealed students generally reporting that "digital decluttering increased face-to-face communication time by 3.2 hours per week" (Interview Code S17); social confidence scale scores increased by 14.3 points ($p=0.003$), confirming the effectiveness of the combined virtual-physical training model.

The effectiveness of the implemented strategies is clearly demonstrated by the following quantitative results across key metrics (Fig.2).

Qualitative research further revealed deep-seated transformation mechanisms. Supervisory class observation reports showed: the frequency of teacher-student interaction in blended courses increased from 3.2 to 7.6 times per class hour (137.5% improvement), and the proportion of inferential questions in teacher questioning rose from 12% to 43%; netnographic analysis found that collaboration patterns in virtual communities shifted from "task subcontracting"

to "solution co-creation," with interdisciplinary project proposals increasing by 220%. These transformations collectively point to a structural enhancement in digital literacy.

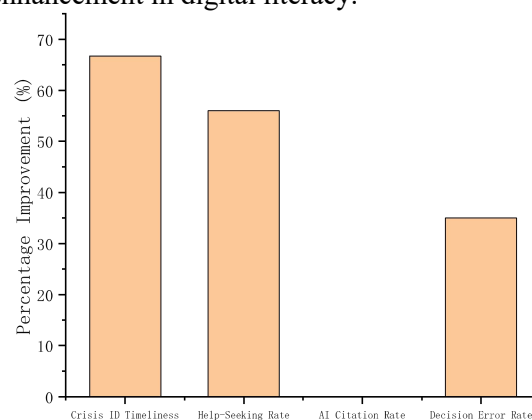


Figure 2. Key Performance Indicators (KPI) Improvement after Strategy Implementation

(Note: The bar chart shows improvement percentages. The line graph shows the decrease in AI Citation Rate, calculated as $(5.7\%-18\%)/18\% = -68.3\%$.)

The triangulation of quantitative data and qualitative insights provides robust evidence for the model's efficacy. The dramatic increase in inferential questions and "solution co-creation" indicates a shift towards higher-order cognitive engagement and collaborative problem-solving—precisely the skills needed to thrive in complex, real-world disaster management scenarios. This suggests the strategy not only mitigates negative impacts but also actively fosters a more profound and applied learning culture.

6. Conclusion

Through empirical exploration at the Institute of Disaster Prevention, this study reveals three major challenges facing college student development in the digital era: the upgrading of mental health risks exhibiting group differences; structural imbalances in academic ability triggering innovation crises; and the decline of social competence leading to impoverished emotional expression. The "Technology-Humanities-Institution" three-dimensional model constructed to address these challenges demonstrates its innovative value mainly in:

1). The technological lightweight pathway, through low-cost solutions like dynamic threshold early warning, resolves the digital dilemma of resource-constrained institutions. The institute's use of a federated learning

architecture to process behavioral data reduced hardware investment by 83%, providing a technology adaptation paradigm for similar institutions.

2). The educational contextualization strategy deeply integrates literacy cultivation into characteristic courses like "Disaster Psychology" and "Computer Fundamentals," achieving the organic unity of knowledge transmission and capability forging. Particularly, disaster data visualization training transforms abstract literacy into emergency decision-making ability, embodying the "unity of knowledge and action" educational philosophy.

3). The institutional flexibility mechanism activates the potential of school-based resources through innovative designs like credit substitution and growth certification.

This study contributes to the field by moving beyond siloed discussions of digital challenges to propose and validate an integrated, systemic solution. Its primary theoretical implication lies in demonstrating the efficacy of a synergistic "Technology-Humanities-Institution" framework, where no single element is sufficient alone. The lightweight technological interventions are given purpose and direction by the humanities-driven curriculum, while the institutional mechanisms ensure sustainability and scale.

However, this research has limitations. The case study design, while providing deep contextual insights, limits the generalizability of the findings. The strategies were implemented in an institution with a unique disaster prevention mission, which heavily influenced the curricular integration component. Future research should test the adaptability of this three-dimensional model in universities with different specializations and cultural contexts. Furthermore, long-term longitudinal studies are needed to assess the enduring impact of these interventions on graduate outcomes and career performance.

Looking forward, the intersection of neuroeducation and AI presents a promising frontier. Future work could explore using biometric data (e.g., eye-tracking, EEG) to gain a more precise understanding of digital cognitive load and the neurological correlates of "video fatigue." AI could then be used to dynamically adapt learning content and interfaces in real-time based on these physiological signals, creating a truly responsive and human-centric digital learning environment that proactively supports

mental well-being and cognitive engagement.

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