Journal of Contemporary Educational Research, 2025, Volume 9, Issue 10
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

A Study on the Cumulative Effects of AI-Powered Campus Positive Initiatives on Cultivating Positive Emotions and Psychological Capital among College Students

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Abstract: Higher education is transitioning from mass expansion to high-quality development. In this process, mental health issues among college students have become increasingly prominent, encompassing not only academic stress-induced anxiety but also complex challenges such as interpersonal adaptation difficulties and career planning confusion. Traditional "problem-oriented" intervention models have shown limitations in responsiveness and adaptability, often only passively addressing existing psychological crises rather than preventing them in advance. This study aims to explore an AI-powered "positive psychology" proactive intervention model through developing an intelligent system. The system automatically collects, filters, and personalizes recommendations for positive activities on campus. Using a randomized controlled trial design, we conducted an 8-week intervention study involving 126 college students at a university. The study found that AI-based "campus positive activity" recommendations effectively boost students' positive emotions and promote psychological capital development through cumulative micro-interventions. This provides universities with empirical evidence and innovative methods to implement low-cost, efficient, and scalable mental health promotion programs through smart technology.

Keywords: Artificial intelligence; Positive event push notifications; Positive emotions; Psychological capital; College students; Cumulative effect

Online publication: November 12, 2025

1. Introduction

College students are at a critical stage of personal growth, facing multiple challenges including academic pressure, interpersonal relationships, career planning, and self-identity. Their mental health issues have become a focal point of social concern, with recent years seeing a slight increase in cases of students taking leave or dropping out due to psychological problems. For years, universities have primarily adopted a "problem-

oriented" approach to mental health education—focusing on identifying and intervening with students already experiencing psychological distress. While this model has its advantages, it also has notable limitations: excessive resource consumption, narrow service coverage, and even potential stigmatization, which may lead students to avoid seeking help due to fear of being labeled as "mentally troubled." These factors often result in many students choosing to avoid seeking help when encountering psychological distress, ultimately causing delayed intervention and failing to address the root causes of the issues.

In contrast, the Positive Psychology movement spearheaded by Martin Seligman and Csikszentmihalyi emerged as a timely response, offering a groundbreaking paradigm for mental health education [1]. This approach emphasizes that psychological research should not merely focus on repairing psychological damage, but rather prioritize cultivating individuals' positive qualities and potential. For instance, it advocates guiding people to focus on positive life experiences and identify their strengths rather than simply addressing existing psychological issues. Within this framework, the Broaden-and-Build Theory of Positive Emotions suggests that positive emotions can expand an individual's immediate thinking and action scope, while building lasting personal resources including psychological capital [2]. Psychological capital is defined as "a positive psychological state demonstrated during growth and development," primarily comprising four dimensions: self-efficacy, resilience, hope, and optimism [3]. Extensive research shows that high levels of psychological capital not only effectively buffer stress but also enhance academic achievement and subjective well-being. For example, students with high psychological capital are more likely to proactively adjust their learning methods when facing exam failures, rather than succumbing to self-denial [4].

However, universities face a significant challenge: how to translate the theories of positive psychology into large-scale, sustainable daily practices. The rapid development of artificial intelligence (AI) in recent years has provided an opportunity to address this issue [5]. AI demonstrates advantages in personalized recommendations, content generation, and user interaction, making it an effective tool for implementing positive psychological interventions [6]. Existing research has attempted to promote positive psychology exercises through mobile applications, achieving short-term results [7]. However, most interventions still rely on preset generic content, making it difficult to closely integrate with students' real campus life scenarios.

Campuses inherently function as vibrant ecosystems teeming with dynamic activities. When these uplifting moments are captured and presented in real time, they naturally inspire students' positive emotions [8]. Building on this insight, our research proposes developing an AI-powered "Campus Positive Activity" recommendation system that delivers targeted content through personalized, context-aware micro-interventions [9]. The system automatically gathers, identifies, and categorizes campus positivity events from multiple sources, including official websites, social media, and student submissions, then generates customized recommendations based on user profiles. This innovative approach offers three key advantages: First, it integrates positive psychological cultivation into daily life through proactive engagement; second, it captures user attention by showcasing tangible campus events; third, it employs a high-frequency, low-intensity exposure strategy that creates cumulative effects through consistent exposure, akin to the principle of "accumulating small gains into significant results."

Based on the above background, this study puts forward the following research questions and hypotheses:

This study aims to explore whether the intelligent push of "campus positive activities" driven by artificial intelligence technology can effectively improve the positive emotions and psychological capital of college students, and whether positive emotions play a mediating role in this process.

The study proposes hypothesis H1: After intervention, the experimental group receiving intelligent push

"campus positive activities" will have a higher positive emotion level than the control group.

The study proposes hypothesis H2: The experimental group will gain higher levels and dimensions of psychological capital through the intelligent push of "positive campus activities" after intervention, compared with the control group.

The study proposes hypothesis H3: Positive emotions mediate the relationship between the "Campus Positive Activity" push intervention and the enhancement of psychological capital.

This study adopts the strict random control experiment method to verify the effectiveness of this new intervention mode and provide theoretical support and empirical basis for the expansion of the connotation and practical application of digital mental health services in colleges and universities.

2. Research methods

2.1. Research subjects and procedures

Conducted at a comprehensive university, this study initially recruited 150 undergraduate students. Through pre-test screening, 126 valid participants were identified—58 males and 68 females—averaging 19.74 ± 1.25 years of age. These participants scored in the lower-middle range on both the Positive Affect Scale and Psychological Capital Scale. Participants were randomly assigned to two groups using a random number table: an experimental group of 63 and a control group of 63. No significant differences were found between the groups in demographic variables or pre-test scores (P-value > 0.05), confirming the validity of the grouping (**Table 1**).

This study employed an 8-week pre-post control group experimental design. All participants completed online assessments of the Positive/Negative Emotion Scale and Positive Psychological Capital Questionnaire, both before the experiment and one week after its conclusion. To effectively control for expected effects, all participants were informed that the study focused on "campus information acquisition methods and college life experiences."

Table 1. Details of participants

Group	Number of people (*n*)	Gender distribution (male/female, *n*)	Average age (mean ± SD, years)	Group homogeneity test (*P*)
Experimental group	63	29/34	19.68 ± 1.32	> 0.05
Control group	63	29/34	19.80 ± 1.18	> 0.05
Total	126	58/68	19.74 ± 1.25	-

2.2. Research tools

The Positive and Negative Affect Scale (PANAS), developed by Watson *et al.* and revised for Chinese users, is a widely recognized tool in affective assessment with high reliability and validity [10]. This scale comprises 20 adjectives: 10 for positive affect (PA) and 10 for negative affect (NA). Participants rate their subjective experience of each emotion on a 5-point scale, where 1 indicates "very mild or almost none" and 5 represents "very intense." In this study, the Cronbach's α coefficient for PANAS was 0.89 in the pre-test and 0.91 in the post-test.

Positive Psychological Capital Questionnaire: This study utilizes the Chinese version of the scale developed by Zhang *et al.*, which aligns with the psychological capital model proposed by Luthans *et al.* [11,12].

The 26-item questionnaire comprises four subscales: Self-Efficacy, Resilience, Hope, and Optimism. Responses are scored using a 7-point Likert scale, where higher total scores indicate greater psychological capital levels. In this research, the Cronbach's alpha coefficient reached 0.93 in the pre-test and improved to 0.95 in the post-test.

AI-Powered Intelligent Recommendation System: This study developed an AI-based recommendation system utilizing pre-trained natural language processing (NLP) models like BERT for sentiment analysis and topic classification. The technical framework draws from mainstream social media sentiment analysis methodologies [13], with the workflow comprising: (1) Data collection: Textual data was harvested from university official websites, student union WeChat accounts, and club Weibo accounts, covering both officially published academic competitions, cultural performances, and student-initiated high-quality content such as public welfare initiatives and academic seminars. (2) Event identification and classification: BERT and other pre-trained NLP models were employed to analyze text sentiments and categorize topics. (3) User profiling: After obtaining user authorization, professional backgrounds, club membership information, and browsing history were collected to build an interest tagging system. (4) Personalized recommendations: Through collaborative filtering and content filtering algorithms, summaries of "Campus Positive Activity" were generated and delivered via daily scheduled notifications. See **Table 2** for the details of these tools.

Table 2. Research tools

Tool name	Author/ version	Measure content/ core features	Number of entries/modules	Scoring formula	Reliability and validity studies (Cronbach's α)
Positive and Negative Affect Scale (PANAS)	Watson *et al.* (China Revised Edition)	Positive Affect (PA), Negative Affect (NA)	20 (PA10/NA10)	5-point scale (1 = very mild, 5 = very strong)	Before: 0.89; after: 0.91
Positive Psychological Capital Questionnaire	Zhang and others independently developed it	Self-efficacy, resilience, hope, optimism	26 (4 dimensions, each containing corresponding entries)	7 points (the higher the total score, the stronger the psychological capital)	Before: 0.93; after: 0.95
AI Intelligent Recommendation System	This study was independently developed	Collect, identify, and personalize campus activities	4 core modules	No (Feature System)	-

3. Results

3.1. Common method deviations and controls

This study conducted unrotated exploratory factor analysis using Harman's single-factor test on all variables, revealing five factors with eigenvalues greater than 1. The first factor explained 28.7% of the variance, below the 40% threshold, indicating no significant common method bias.

3.2. The effect of positive emotion intervention

This study employed a 2×2 repeated measures ANOVA with positive emotion scores as the dependent variable. Results indicated significant time main effects ($F = 28.36$, $P < 0.001$), while group main effects were relatively limited. Notably, the interaction between time and group demonstrated statistical significance ($F = 31.52$, $P < 0.001$). Simple effect analysis revealed that the experimental group achieved significantly higher positive emotion scores in the post-test compared to pre-test ($t = 7.95$, $P < 0.001$), and markedly outperformed the control group's post-test scores ($t = 8.12$, $P < 0.001$). The control group showed only a 0.07 difference between pre-and post-test scores, which was not statistically significant ($P > 0.05$). The experimental group's positive

emotion score improvement was over 10 times greater than the control group, strongly supporting Hypothesis H1 (**Table 3**).

Table 3. Positive emotion intervention

Group	Positive emotion pre-test (mean ± SD)	Positive emotions post-test (mean ± SD)	Psychological capital pre-test (mean ± SD)	Psychological capital post-test (mean ± SD)
Experimental group	3.12 ± 0.45	3.87 ± 0.51**	4.21 ± 0.63	5.02 ± 0.58**
Control group	3.08 ± 0.47	3.15 ± 0.49	4.18 ± 0.65	3.23 ± 0.61

3.3. The effect of psychological capital intervention

When conducting repeated measures ANOVA with total psychological capital scores as the dependent variable, the results indicated significant time main effects while group main effects were not prominent. The time-group interaction demonstrated statistically significant effects. Simple effect analysis revealed that the experimental group achieved significantly higher post-test psychological capital scores compared to both pre-test and control groups, whereas no substantial differences were observed between pre- and post-test scores in the control group. Multidimensional analysis showed that the experimental group scored higher than pre-test levels and the control group post-test scores in dimensions including self-efficacy, psychological resilience, hope, and optimism. These findings strongly support the research hypothesis H2 (**Table 4**).

Table 4. Psychological capital intervention

Psychological capital dimension	Pre-test score (mean ± SD)	Post-test score (mean ± SD)	Increment (before and after testing)
Self-efficacy	3.98 ± 0.71	4.75 ± 0.62	0.77
Tenacity	4.05 ± 0.68	4.81 ± 0.59	0.76
Hope	4.23 ± 0.65	5.03 ± 0.60	0.80
Hopeful	4.36 ± 0.63	5.12 ± 0.57	0.76

3.4. Analysis of the mediating effect of positive emotion

This study employed group membership as the independent variable, post-test scores of psychological capital as the dependent variable, and post-test scores of positive emotions as the mediator variable. Through 5,000 bootstrap self-sampling analyses, the results revealed that direct intervention showed highly statistically significant effects on psychological capital. The role of positive emotions as a mediator was equally significant, accounting for 43.05% of the total effect (**Table 5**). This indicates that the "Campus Positive Activity" program not only directly enhanced psychological capital levels but also indirectly promoted their development by stimulating and strengthening students' positive emotions. Consequently, hypothesis H3 was validated.

Table 5. The mediating effect of positive emotion

Effect type	Total effect	Exclusive sharing
Direct effect	56.95%	56.95%
Indirect effect (mediated by positive emotions)	43.05%	43.05%

4. Discussion

This study provides compelling evidence that AI-powered "campus positive activities" notifications significantly enhance college students' positive emotions and psychological capital. The daily exposure to personally relevant positive events aligns with the "micro-moment" accumulation mechanism in the Extended Construction Theory [14]. Furthermore, the improvement in psychological capital may be achieved through social observational learning and emotional arousal pathways [15]. The research offers empirical support for promoting digital psychological interventions in higher education, resonating with current trends in "intelligent psychology" studies [16]. The findings demonstrate that personalized positive event notifications delivered over eight weeks effectively elevate students' positive emotional levels, consistent with Frederickson's Extended Construction Theory. Daily engagement with personally relevant, immediate positive events provides students with sustained emotional stimulation. These accumulated "positive micro-moments" may break down the "negative filter" formed by excessive academic pressure or negative information, helping students rediscover and perceive the positive aspects of campus life, thereby achieving a qualitative transformation in emotional experiences from quantitative changes.

A groundbreaking study reveals that this intervention not only improves emotional well-being but also enhances the accumulation of positive psychological resources (psychological capital). This demonstrates that AI-driven positive events are not fleeting motivational platitudes, but rather hold the potential to build long-term psychological assets. The mechanisms may include: observing peers' academic achievements (e.g., competition awards) boosts self-efficacy; witnessing student teams overcome challenges to successfully complete events strengthens resilience; exposure to diverse club activities and career development seminars broadens perspectives, establishes multifaceted goals, and heightens hope. Continuous engagement with positive campus environment information subtly shapes individuals' optimistic interpretation styles regarding current life and future development.

The mediation analysis demonstrates that positive emotions partially mediate the impact of intervention measures on psychological capital. This finding provides empirical support for expanding the constructivist theory framework, revealing that interventions first stimulate students' interest, pleasure, and pride through content engagement. These positive emotional experiences subsequently motivate students to explore environments, adopt new behaviors, build social connections, and construct cognitive maps, thereby gradually accumulating more enduring psychological capital resources. This mechanism reveals the intrinsic pathway from "emotional arousal" to "resource construction."

This study holds significant practical value, offering universities an economically efficient and easily implementable new approach to mental health promotion. By leveraging technological tools, it systematically and personally showcases scattered yet often overlooked positive resources on campus—such as niche club activities and inspiring stories of ordinary students. This strategy avoids the homogenization caused by merely pushing large-scale official events, enabling positive psychology interventions to become routine, integrated into daily life, and scaled up for widespread implementation.

5. Conclusion and perspectives

The research findings demonstrate that AI-driven "campus positive activities" effectively enhance college students' positive emotions, thereby fostering psychological capital development through cumulative effects. This validates the feasibility and effectiveness of integrating AI technology with positive psychology theories in promoting mental health among university students.

Despite certain limitations—such as the 8-week experimental period requiring long-term follow-up verification and the single-institution sampling needing validation across different academic settings—the study remains of significant reference value. Moreover, it fails to thoroughly examine the distinct impacts of achievement-oriented activities versus relationship-focused activities.

Future research should focus on three key directions: First, conducting long-term follow-up studies to evaluate the sustainability of intervention effects. Second, leveraging artificial intelligence to optimize content effectiveness analysis and refine recommendation algorithms. Third, investigating the model's differential impacts on student groups with distinct characteristics (such as personality differences and psychological capital levels) to inform targeted interventions. This study provides valuable insights and empirical support for building an "intelligent psychological education" system, driving university mental health education from passive response to proactive prevention and growth support.

Disclosure statement

The authors declare no conflict of interest.

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