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Measurement and Countermeasures for College Students' Emotions and Attitudes Post-popular Feelings Events: An Analysis Based on Smart PLS Model Data

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Abstract: - To accurately gauge the emotional and attitudinal responses of college students post-popular feelings events, and to formulate scientifically sound strategies for managing public sentiment effectively and forestalling secondary quandaries, a pioneering big data simulation approach is introduced. This method, utilizing big data collection and processing techniques, entails the random sampling of a substantial number of college students to gather evaluative data on their emotional and attitudinal shifts before and after popular feelings events, as well as the efficacy of countermeasures. Subsequent to this, the amassed data undergoes meticulous fitting analysis via the Smart PLS 4.0 software. Noteworthy among the impact coefficients are negative emotions (r=0.146), negative attitudes (r=0.132), and the pivotal role of student opinion leaders (Loading=0.921). The standardized root mean square residual (SRMR) of 0.049 underscores the confirmatory model's relevance. Results underscore the need for countermeasures to place a significant emphasis on mitigating negative emotions among college students. Selection of student opinion leaders and the establishment of rumor-refutation teams emerge as vital components of these response initiatives.

Keywords: Smart PLS; data analysis; popular feelings events; college students; emotions and attitudes

I. INTRODUCTION

The advancement and application of computer big data have enabled the pursuit of simulating and researching shifts [1] in college students' emotions through extensive data analysis. Leveraging the formidable data collection and processing capabilities of computers allows for precise measurements of college students' emotions and attitudes [2], thereby offering a more scientifically informed guidance on the trajectory of their emotions [3].

According to the 52nd release of the China Internet Development Statistics Report by the China Internet Network Information Center (CNNIC), as of June 2023, the number of internet users in China has reached 1.079 billion, marking an increase of 11.09 million people compared to December 2022, with an internet penetration rate of 76.4%.

The evolution of the internet from a realm of quantity to quality is profoundly reshaping how people engage with information. A growing number of individuals are now inclined to share their viewpoints and opinions on online platforms, consequently exerting substantial influence over the genesis and evolution of public sentiments [4]. The openness and interactive nature of online media provide a space where diverse perspectives and varied interests converge, erasing the barriers that once separated individuals.

Compared to traditional forms of opinion dissemination, the internet offers a faster and more accessible platform for free expression. In this dynamic communication landscape, individuals wield the power to create and share news, blurring the lines between sender and receiver.

The transformative impact of the internet is strikingly evident in how swiftly popular feelings events unfold in college settings, where even the slightest misstep can trigger cascading secondary reactions.

Consequently, colleges are compelled to devise meticulous strategies to navigate public sentiments [5], accurately gauge the emotional and attitudinal shifts among students in the aftermath of such incidents, and comprehensively and judiciously steer the course of their emotional trajectories.

Within the realm of the top ten domestic popular feelings events cataloged by "Toutiao" in 2023, a spotlight falls on four incidents directly tied to educational institutions. Delving deeper into these occurrences unveils a startling revelation - the year 2023 witnessed a cascade of double-digit incidents exclusively clustered around educational domains. Notably, institutions of higher learning have emerged as pivotal epicenters for the burgeoning wave of online public sentiment, drawing profound scholarly attention and fostering a rich tapestry of theoretical inquiries. In this intellectual landscape, Hua Wang's (2023) application of the DEMATEL-ANP Fuzzy

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Comprehensive Model to gauge the urgency of digital public sentiments [6], alongside Jasman Saripuddin Hasibuan's (2024) utilization of the Partial Least Squares (SmartPLS) [7] methodology to probe strategic employees' emotional vicissitudes[8], reflects a scholarly quest for understanding amidst this upheaval. Following the occurrence of popular feelings events, there remains a notable void in accurately gauging the emotional and attitudinal shifts among university students. It is apparent that the countermeasures and strategies employed by different colleges [9] towards popular feelings events often rely on intuitive handling, exhibiting a pronounced subjectivity. Decision-making in response lacks substantial objective data support, resulting in a lack of precise monitoring of the emotional and attitudinal changes among college students and the general online population post-popular feelings events. This deficiency frequently leads to inadequacies in managing public opinion, consequently sparking secondary crises.

Among these incidents lies the notorious "Duck Neck Incident", which ignited a firestorm of controversy. On June 1, 2023, a video surfaced online alleging the discovery of a rat head in a meal served at a college in Jiangxi. Subsequent responses from the school administration and local market regulatory authorities, asserting that the foreign object was actually a duck neck, failed to quell public skepticism. As the public sentiment continued to brew, what began as a mere food safety concern swiftly metamorphosed into a widely scrutinized public discourse. On June 17, a collaborative investigative unit comprising various government entities in Jiangxi released its findings, affirming that the foreign object indeed belonged to the rodent family, thus triggering a dramatic reversal in the narrative. The statistical analysis of big data in Figure 1 reveals that on June 17, the number of attention hits during the second day of the popular feelings event soared to 120,000, far surpassing the initial level of attention during the first occurrence. Throughout the escalation of this public opinion crisis, a plethora of trending terms, memes, and visuals blending various elements of the event, such as "calling a rat a duck", flooded discussion forums and hot search topics, fostering a viral effect through tag-based dissemination. The emergence of this secondary public opinion crisis inflicted significant damage on the credibility of both the colleges and grassroots government entities involved.

Figure 1: Trend Chart of the 2023 "Duck Neck Incident"

Conventional countermeasures to crises within higher education institutions often fall short in accurately discerning the genuine sentiments and attitudes of both on-campus students and the broader online community. The lack of precise understanding of the mechanisms driving online sentiment propagation, coupled with an inadequate grasp of the pressures imposed by online discourse, frequently leads to impulsive, experiential, and untimely actions. These varied countermeasures yield significantly different outcomes, occasionally giving rise to secondary waves of public sentiment.

II. Model Development and Questionnaire Design

Partial Least Squares Structural Equation Modeling (PLS-SEM) is a widely favored method for analyzing multivariate data [10], commonly employed to conduct extensive data simulation analyses on complex models [11]. With the advancement of big data analytics technologies, the prominence of PLS-SEM models in the realm of network information systems [12] has grown significantly. Salem Alkhalaf (2012) utilized the Smart PLS tool to measure the effectiveness of learning systems [13], while Olier, J.S., Spadavecchia, C (2024) employed socio-economic indicators to gauge the emotions of immigrants [14]. In this study, a synthesis of tools including psychological mechanisms of online sentiment and attitude propagation, emotional scales for college students, and attitude measurement scales for college students are incorporated. Smart PLS [15] structural equation modeling [16] is employed to measure and analyze the emotions and attitudes of on-campus students following a popular feelings event [17]. Through the development of a model showcasing the transmission of emotions and attitudes among college students post-popular feelings event, as depicted in Figure 2, a quantitative analysis approach is utilized to precisely gauge the relationship between student emotions, attitudes, and countermeasures. This

endeavor aims to provide a scientific basis for higher education institutions in formulating strategies to address public sentiment effectively.

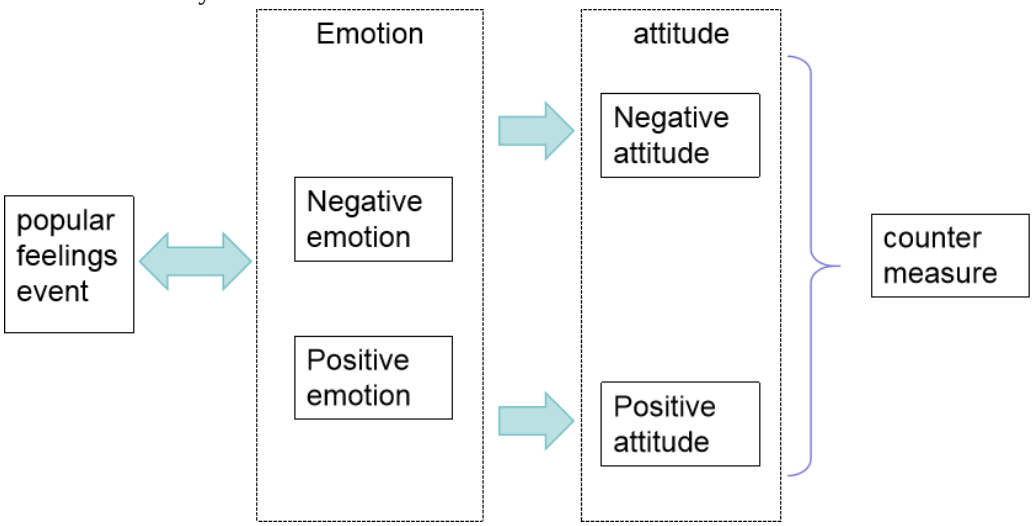

Figure 2: Model of Emotional and Attitudinal Transmission among On-campus College Students Post Popular Feelings Events

The research primarily employs online questionnaire surveys and, considering the current state of public sentiment management in domestic higher education institutions, designs surveys to investigate the emotions and attitudes of on-campus college students following popular feelings events. Emotion scales [18] and attitude scales are utilized for assessment and measurement. This effort aims to provide a reference point for designated countermeasures in higher education institutions following public sentiment occurrences.

College Education Public Sentiment Survey Questionnaire mainly encompasses four sections: Basic information of college students, Emotion Scale, Attitude Scale, and Countermeasures. The College Student Emotion Scale draws inspiration from the Achievement Emotions Questionnaire (AEQ) developed and published by Pukrun [19] et al. in 2005, categorizing emotions into positive and negative aspects, distilled into nine sub-items: sadness, boredom, disappointment, anger, anxiety, joy, hope, pride, and excitement. The College Student Attitude Scale, based on Krathwohl's [20] theory of affective domain objectives, is divided into positive emotional attitudes [21] and negative emotional attitudes, comprising ten sub-items.

III. Investigation and Analysis of Current State of Public Sentiment in College Education

A. Research Subjects and Internet Usage Patterns

In the sample collection process, this study employs a random sampling method and randomly selects 1,200 undergraduate students as survey subjects, ultimately obtaining 956 valid questionnaires. The specific composition of the sample is illustrated in Table 1. Among the participants, there are 349 male students and 607 female students, with slightly more males than females. Regarding internet usage patterns, the most common choice is spending 2-5 hours online daily, with 408 individuals, accounting for 42.7% of the sample. On the other hand, only 2.9% of individuals report not using the internet at all. Those who spend over 5 hours online daily comprise nearly 31% of the sample. From the perspective of internet usage time, it is evident that the internet has become a significant habit in the lives of college students.

Table 1: Sample Composition (N=956)

items	value	sample number (person)	Percent (%)
Gender	Male	349	36.5
	Female	607	63.5
Average time spent online per day	Not using the internet at all	28	2.9
	1-2 hour(s)	221	23.1
	2-5 hour(s)	408	42.7
	More than 5 hour	299	31.3

B. Analysis of Online Engagement (Commenting and Dissemination of False Information)

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The statistical results as shown in Figure 3 regarding whether individuals post comments online reveal that only 12.8% refrain from commenting. The proportion of individuals who do engage in posting comments stands at 81.2%. Among those who comment, the percentages of individuals who do so always or often are 5.1% and 3%, respectively. This data reflects the active participation of college students in commenting activities. In today's digital landscape, enriched platforms make the dissemination of online information increasingly convenient, attracting a growing number of participants and accelerating the speed of dissemination. Consequently, the impact of online public sentiment within colleges continues to expand.

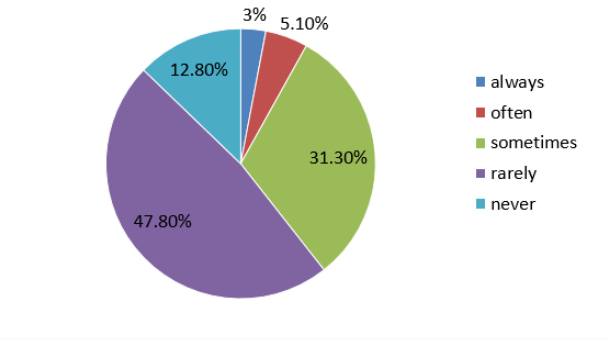

Figure 3: Analysis of Online Commenting Behavior

According to the survey results, 87.9% of individuals refrain from sharing false information online, while 9.5% seldom engage in such practices. The combined total of these two groups stands at 97.4%. This indicates that the majority of college students conscientiously abstain from spreading falsehoods. However, a small fraction of individuals still tends to follow the trend and disseminate inaccurate information. This behavior is mainly facilitated by the anonymity of online media, allowing disseminators to express views with a certain level of irresponsibility. Consequently, this not only contributes to a more dynamic online public sentiment but also renders the content of public sentiment more intricate. As shown in Figure 4.

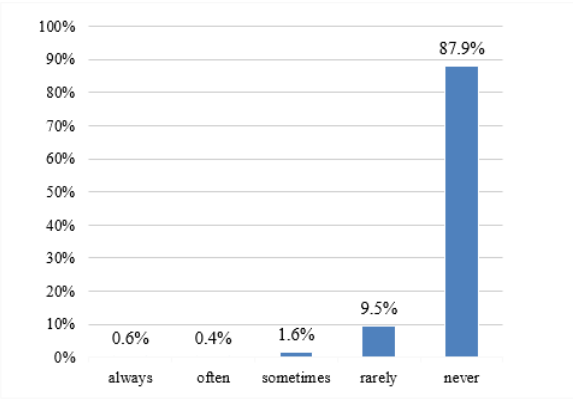

Figure 4: Survey Results on the Dissemination of False Information Online

The survey results as shown in Figure 5 regarding attitudes towards commenting on online events illustrate that 680 college students, constituting 71.1% of the participants, believe they can approach discussions rationally. Nearly 29% of college students, on the other hand, acknowledge being influenced by the emotions of online influencers or individuals in their social circle, hindering their ability to make impartial judgments.

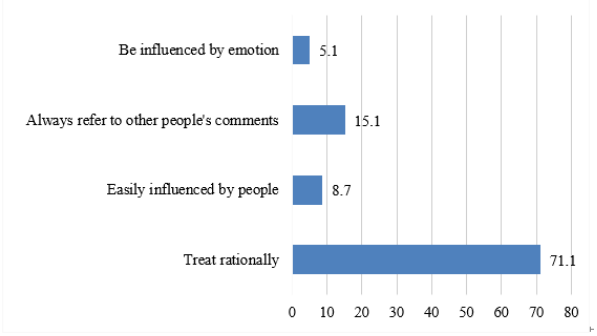

Figure 5: Survey Results on Attitudes when Commenting on Online Events

Engaging with online public sentiment and comments in an emotional manner is a common attitude. However, blindly conforming to others' viewpoints without mature reflection can result in the proliferation of false information and the emergence of emotionally charged secondary public sentiment.

C. Survey on Online Rumors

With the rapid advancement of internet technology, the openness of the internet has facilitated the dissemination of information, making it increasingly challenging to monitor and manage online content, leading to the rampant spread of online rumors. Results from the statistical analysis of the frequency of exposure to online rumors in Figure 6 reveal that 7% of individuals are always exposed to rumors, 24.7% encounter them often, 51.3% come across them sometimes, 14.2% rarely encounter them, and only 2.8% have never been exposed. This survey outcome underscores the extensive reach of online rumors. Subsequently, this study delves into the discernment capabilities concerning rumors. The statistical findings in Figure 7 indicate that only 17.1% of individuals can easily distinguish rumors, 61.2% possess a basic level of discernment, 20.9% struggle with vague cases, and a mere 0.8% are entirely unable to distinguish. In the midst of the intricate landscape of online information today, failure to accurately distinguish rumors can lead to a cycle of misinformation, consequently contributing to turmoil within the public discourse.

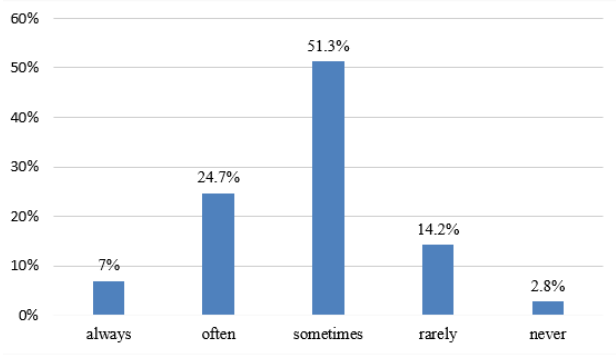

Figure 6: Statistical Analysis of the Frequency of Exposure to Internet Rumors

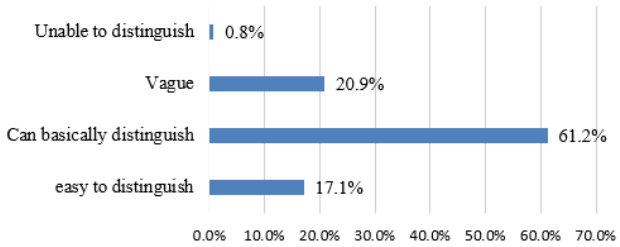

Figure 7: Network Rumor Discrimination Ability

IV. Measurement and Model Analysis of Emotions and Attitudes

A. Measurement of Emotions and Attitudes among College Students after Popular Feelings Events

In this section, a paired sample t-test method is employed to conduct comparative analyses of emotions and attitudes among college students following popular feelings events. The research contrasts the emotions and attitudes of students under the stimulus of public opinion events. Student states are measured using a five-point Likert scale, where a score of 1 indicates strong disagreement, 2 signifies moderate disagreement, 3 signifies uncertainty, 4 denotes moderate agreement, and 5 indicates strong agreement. As the score ascends, the level of agreement rises, reflecting a higher level of conformity to the description of the state.

Emotional and attitudinal measurement post popular feelings events.

From Table 2, it is evident that under the stimuli of popular feelings events, the paired sample T-test for negative emotions and positive emotions shows a significance level of p-value (two-tailed) less than 0.05, reaching statistical significance. This indicates a notable difference in the levels of these two emotions. Table 3 illustrates that the mean score for negative emotions stands at 3.80, surpassing the mean score for positive emotions at 1.77. This suggests that negative emotions significantly outweigh positive emotions. Following popular feelings events,

college students exhibit significantly higher levels of negative emotions compared to positive ones, signifying a shift towards negativity in their emotional responses influenced by public sentiment.

Table 2: Paired Sample T-test for Emotions and Attitudes Comparison

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Negative emotions - Positive emotions	2.03316	1.45306	.04700	1.94093	2.12539	43.263	955	.000
Pair 2	Negative attitude - Positive attitude	1.76046	1.27214	.04114	1.67972	1.84120	42.788	955	.000

Table 3: Descriptive Statistical Table for Emotions and Attitudes Comparison

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Negative emotions	3.8036	956	.95693	.03095
	Positive emotions	1.7704	956	.85994	.02781
Pair 2	Negative attitude	4.1519	956	.92093	.02978
	Positive attitude	2.3914	956	.67491	.02183

Amidst the influence of popular feelings events, the paired sample T-test for negative attitudes and positive attitudes reveals a significant p-value (two-tailed) lower than 0.05, reaching a noteworthy level of statistical significance. This indicates a substantial disparity in the levels of these two attitudes. Furthermore, with negative attitudes having a mean score of 4.15, exceeding the mean score for positive attitudes at 2.39, it is clear that negative attitudes significantly surpass positive attitudes. Following popular feelings events, college students exhibit significantly higher levels of negative attitudes compared to positive ones, highlighting a tendency towards a more pessimistic attitude influenced by public discourse.

B. Comparative Analysis of the Situation Before and after Secondary Popular Feelings Events

A comparative analysis of emotions and attitudes among students before and after secondary popular feelings events reveals the following:

Table 4: Measurement of Emotions and Attitudes before Secondary Popular Feelings Events

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Negative emotions	3.4282	248	.96330	.06117
	Positive emotions	2.0282	248	.89120	.05659
Pair 2	Negative attitude	3.7339	248	.99496	.06318
	Positive attitude	2.5565	248	.65661	.04169

Table 5: Measurement of Emotions and Attitudes after Secondary Popular Feelings Events

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Negative emotions	4.0947	243	1.01106	.06486
	Positive emotions	1.5905	243	.84491	.05420
Pair 2	Negative attitude	4.5276	243	.84032	.05391
	Positive attitude	2.3465	243	.69444	.04455

Table 6: Comparison of Emotions and Attitudes before Secondary Popular Feelings Events

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Negative emotions - Positive emotions	1.40000	1.43238	.09096	1.22085	1.57915	15.392	247	.000
Pair 2	Negative attitude - Positive attitude	1.17742	1.29144	.08201	1.01590	1.33894	14.358	247	.000

Upon comparing emotions and attitudes before and after secondary popular feelings events, as depicted in Tables 4 and 5, it is observed that among college students, the score for negative emotions increased from 3.43 before the popular feelings event to 4.09 after the secondary incident—a variance of 0.66 points. This indicates a

noticeable exacerbation of negative emotions among students following the secondary popular feelings event. Tables 6 and 7 further reveal that in the paired sample T-test comparison, the significance value is 0.000, lower than 0.05, reaching a level of statistical significance. Hence, the exacerbation of negative emotions among college students post the secondary popular feelings event holds statistical significance, highlighting a marked increase in negativity among students on campus.

Table 7: Comparison of Emotions and Attitudes after Secondary Popular Feelings Events

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Negative emotions - Positive emotions	2.50412	1.43323	.09194	2.32301	2.68522	27.236	242	.000
Pair 2	Negative attitude - Positive attitude	2.18107	1.09400	.07018	2.04283	2.31931	31.078	242	.000

Examining negative attitudes among college students, as illustrated in Tables 4 and 5, it is evident that the score for negative attitudes increased from 3.73 following the initial popular feelings event to 4.52 after the subsequent incident—a shift of 0.79 points. This indicates that the occurrence of the secondary popular feelings event has further fueled a pessimistic outlook among college students. Tables 6 and 7, in a similar fashion, indicate that in the paired sample T-test comparison, the significance value is 0.000, below the threshold of 0.05, reaching a statistically significant level. Consequently, the post-secondary popular feelings event has significantly amplified the presence of negative attitudes among college students, underscoring a more pronounced manifestation of negativity in their demeanor.

C. Smart PLS Model Data Analysis

The structural equation model typically comprises two fundamental models: the measurement model and the structural model [22]. Through an extensive review of theory and empirical research, following a detailed analysis of the internal structure and overall architecture of the research model, it has been observed that the theoretical model in this study is well-founded. Subsequently, a more in-depth exploration of the relationships among latent variables has been undertaken.

The partial least squares (PLS) algorithm is employed for the structural equation model in this study, utilizing Smart PLS 4.0 [23] software for conducting significance tests on the data with a sample size of 5000 units. By comparing empirical and variable assumptions, the combination of path coefficients with T-values is utilized, wherein a p-value less than 0.05 and a T-value greater than 1.96 signify the significance of the test results. Upon analyzing the research hypotheses and model, and conducting reliability and validity analyses as well as evaluating path coefficients and significance, the model computational results are as follows. The organized model data results are presented below:

1) Structural validity examination

Table 8: Structural Validity Examination

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted
Negative attitude	0.888	0.891	0.889	0.617
Negative emotions	0.849	0.864	0.847	0.532
Positive attitude	0.882	0.889	0.877	0.592
Positive emotions	0.819	0.822	0.816	0.528
Countermeasures	0.907	0.912	0.905	0.616

The results of the structural validity examination presented in Table 8 indicate that the Cronbach's α reliability coefficients for each element are all above 0.7. The composite reliability (CR) values are also above 0.7, and the average variance extracted (AVE) values exceed 0.5. With all measurement indices demonstrating favorable values, it is apparent that the model exhibits strong structural validity, passing the reliability and validity assessment.

2) Smart PLS model path analysis

Using the partial least squares method in structural equation modeling to assess the model's path impact effects, the research data is incorporated for analysis and model fitting. The fitting results of each parameter are depicted in Figure 8:

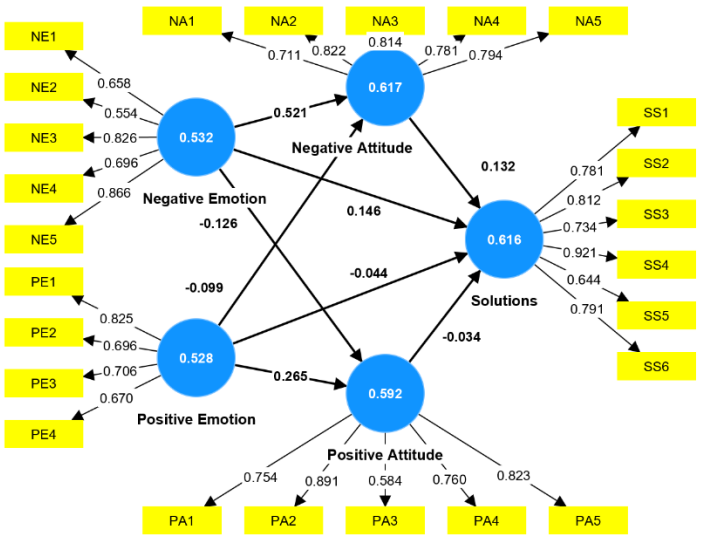

Figure 8: Smart PLS Structural Equation Model Operational Chart

Table 9: Coefficients of the Structural Equation Model

Paths	Coefficient	(STDEV) Standard deviation	T statistics	P value	Conclusion
Negative attitude -> Countermeasures	0.132	0.057	2.330	0.020	Supported
Negative emotions -> Negative attitude	0.521	0.047	11.035	0.000	Supported
Negative emotions -> Positive attitude	-0.099	0.045	2.180	0.029	Supported
Negative emotions -> Countermeasures	0.146	0.057	2.576	0.010	Supported
Positive attitude -> Countermeasures	-0.034	0.048	0.695	0.487	Not Supported
Positive emotions -> Negative attitude	-0.126	0.040	3.146	0.002	Supported
Positive emotions -> Positive attitude	0.265	0.047	5.641	0.000	Supported
Positive emotions -> Countermeasures	-0.044	0.053	0.839	0.402	Not supported

The fitting results of the coefficients in the structural equation model presented in Table 9 indicate that negative emotions have a significant positive impact on countermeasures (B = 0.146, p = 0.02 < 0.05). This suggests that the amelioration of negative emotions contributes to the advancement of countermeasures.

Negative emotions have a significant positive impact on negative attitude (B = 0.521, p = 0.00 < 0.05), indicating that negative emotions can evolve and lead to the formation of negative attitude.

Negative attitude has a significant positive impact on countermeasures (B = 0.132, p = 0.020 < 0.05), suggesting that the improvement of negative attitude facilitates the advancement of countermeasures.

Positive emotions do not exhibit a significant influence on countermeasures (B = -0.044, p = 0.402 > 0.05, not reaching the statistical significance level of 0.05), indicating that positive emotions do not significantly impact the implementation of countermeasures.

Positive attitude also does not significantly influence countermeasures (B = -0.034, p = 0.487 > 0.05, not reaching the statistical significance level of 0.05), implying that positive attitude does not distinctly affect the implementation of countermeasures.

Positive emotions have a significant negative impact on negative attitude (B = -0.126, p = 0.002 < 0.05), suggesting that strengthening positive emotions can ameliorate negative attitude among college students.

Negative emotions have a significant negative impact on positive attitude (B = -0.099, p = 0.029 < 0.05), indicating that the emergence of negative emotions can influence the formation of positive attitude among college students.

In conclusion, the effective management of negative emotions plays a pivotal role in the efficacy of countermeasures. Among the strategies, as depicted in Figure 8, measure SS4 (loading=0.921) - selecting student opinion leaders in colleges and establishing rumor-refutation teams - emerges as the most effective countermeasure.

V. Conclusion and Limitations

Following a popular feelings event in colleges, it is vital for higher education institutions to focus on monitoring the changes in negative emotions and negative attitude among students, with particular emphasis on the

management of negative emotions. Among various countermeasures, the most effective approach involves identifying student opinion leaders and establishing rumor-refutation teams, which can effectively control and mitigate the impact of negative public opinion. Additionally, having a well-equipped team for managing online public opinion within colleges serves as a crucial safeguard.

This study provides a robust foundation for colleges to address popular feelings events and formulate scientifically sound countermeasures. By effectively managing negative emotions among college students, this research enables precise monitoring of emotional shifts among students to preempt secondary public opinion crises. However, due to the reliance on internet technology for massive data collection, the study lacked necessary quality control measures during the information-gathering process, potentially resulting in discrepancies between the fitting results of the Smart PLS model and the actual circumstances.

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