

Evolution Mechanisms and Resilient Governance of Academic Misconduct Discourse in Higher Education Institutions from a Complex Adaptive Systems Perspective

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Abstract

Academic misconduct incidents in higher education institutions, involving sensitive issues such as academic integrity and faculty-student relationships, exhibit characteristics of diverse stakeholders, complex evolution, and far-reaching societal impact, representing a classic manifestation of complex adaptive systems (CAS). Based on CAS theory, this study examines two cases: a joint complaint by 11 students against their advisor at a university in Central China, and allegations surrounding undergraduate student Liu A's 14 SCI-indexed papers at a university in Southwest China. Employing a multi-case comparative approach, it analyzes the evolution mechanisms of academic misconduct discourse and constructs a resilience governance framework. Findings reveal that both cases underwent three stages—"initial outbreak - diffusion and development - multi-party regulation"—exhibiting CAS characteristics such as emergent actor aggregation, nonlinear interactions, and self-organizing adaptation. However, differences exist in actor composition, issue transformation pathways, and system resilience. System dynamics simulation (Vensim) revealed that varying intervention intensities significantly impact public opinion recovery time, rebound magnitude, and secondary outbreak probability. Based on these findings, a resilience governance framework—comprising “stakeholder coordination, mechanism response, and ecosystem cultivation”—is proposed. This framework provides theoretical support and practical pathways for dynamic, precision-targeted governance of academic misconduct public opinion in higher education institutions.

Keywords

Complex Adaptive Systems, Academic Misconduct in Higher Education,

1. Introduction

In the era of omni-media, public opinion is characterised by a diverse range of participants and instantaneous, exponential dissemination. Public opinion regarding academic misconduct in higher education touches upon sensitive issues such as academic integrity and educational equity (Qu & Du, 2017), and exhibits pronounced non-linear characteristics; it has become a prominent issue that threatens the reputation of higher education institutions and disrupts the educational ecosystem (Ye & Pu, 2024; Qian & Wang, 2024). Existing research has predominantly relied on qualitative descriptions (Gu et al., 2024), lacking in-depth analysis and quantitative modelling of the complex nature of public opinion, which has led to challenges in governance such as delayed responses and a lack of precision (Ye et al., 2024). CAS theory aligns closely with the intrinsic attributes of public opinion on academic misconduct in higher education institutions and can overcome the limitations of traditional research (Li et al., 2024). Consequently, higher education institutions need to refine their public opinion response mechanisms, strengthen information disclosure and multi-stakeholder coordination, in order to enhance the effectiveness of public opinion management during emergencies (Gai & Zhu, 2023). This paper takes two typical cases as its subject matter; drawing on CAS theory, it constructs a model, quantifies the effectiveness of interventions and proposes resilient governance strategies, thereby holding both theoretical and practical significance. Higher education institutions should establish long-term governance mechanisms through institutional and technological means, integrate academic integrity education into talent development, implement full-process traceability and data-driven early warning systems for research, collaborate with cyber security departments to address misinformation, and guide rational public discourse. By reducing the incidence of public opinion incidents at source, they can promote the coordinated development of academic integrity and a healthy online ecosystem.

2. Constructing a Resilient Governance Model for Public Sentiment Regarding Academic Misconduct in Higher Education Institutions Based on CAS Theory

Combining an analysis of evolutionary mechanisms with system dynamics modelling, this study constructs a resilience governance framework and uses modelling to clarify the impact of intervention intensity on the resilience of public opinion.

2.1. An Overview of a University Online Public Opinion Monitoring System Based on CAS Theory

From a CAS theoretical perspective, the online public opinion system in higher education institutions is a complex adaptive system formed through the interac-

tion and organic coupling of four major subsystems: diverse actors, information dissemination, technological support, and socio-cultural factors (Liu et al., 2018). In the era of omni-media, the assessment and guidance of the online public opinion environment have become key issues in the governance of higher education institutions (Zhang, 2024). The multi-actor system encompasses core participants such as students, teaching staff, university administrators, the media and the general online public, and serves as the primary vehicle for the generation and evolution of public opinion; the information dissemination system is responsible for the transmission and diffusion of viewpoints, emotions and value judgements, acting as the key link connecting all actors; its immediacy and viral diffusion characteristics within the all-media communication landscape significantly alter the pace at which public opinion evolves (Zhong & Huang, 2024); The technological support system provides the platform and technical foundation for the dissemination of online public opinion, determining the immediacy and viral nature of information dissemination; the socio-cultural system influences the cognitive frameworks and interactive logic of the actors, thereby constraining the direction of public opinion evolution. From the perspective of text analysis, research on online public opinion in Chinese higher education institutions has gradually shifted its focus to the interrelationships between actors, issues and dissemination mechanisms (Xu, 2025).

The core characteristics of CAS theory align closely with the operational logic of online public opinion systems in higher education institutions. The system's intrinsic mechanisms can be analysed through key dimensions such as aggregation, non-linearity and flow; these characteristics interpenetrate to form the foundation for the evolution of public opinion, as shown in Table 1 below.

Table 1. An interpretation of the complex system of online public opinion in higher education institutions based on CAS theoretical characteristics.

Key features	Keywords	An explanation of a complex adaptive system for online public opinion in higher education institutions
Aggregation	Emergence	Public opinion is formed through the aggregation effect of diverse actors in cyberspace; the collective behaviour of these diverse actors gives rise to a public opinion arena.
Non-linearity	Complexity	The evolution of public opinion in higher education institutions does not follow simple cause-and-effect relationships; minor incidents may trigger massive public opinion storms, reflecting the “butterfly effect”.
Flow	Cycle	Within the public opinion system, material, energy and information flows continuously interact and are transmitted, circulating in the form of viewpoints, emotions and the like.
Diversity	Coordination	The public opinion system encompasses different stances and sources of viewpoints; this diversity renders the system more adaptive.

Continued

Identity	Selection	Actors recognise one another through identity markers such as “students”, “teachers” and “the media”, which influences the nature of their interactions.
Internal model	Prediction	Each actor anticipates the direction of public opinion based on their own perceptions, whilst the university administration determines its response strategies according to internal experiential models.
Fundamental characteristics	Keywords	An interpretation based on the complex adaptive system model of online public opinion in higher education institutions.
Building blocks	Combination	Public opinion is composed of basic units such as discourse, emotions and viewpoints; different combinations of these units produce different effects on public opinion.

Within the CAS theoretical framework, the online public opinion system regarding academic misconduct in higher education institutions constitutes a dynamic exchange and multidimensional interplay among diverse actors centred on specific issues; it transcends linear logic, exhibiting non-linearity and multi-layered characteristics (Yang, 2025). Non-linearity manifests in the way that minor disturbances by individuals can be amplified through positive feed-back within the network, triggering sudden shifts in public opinion; in the age of algorithms, platform-driven algorithmic recommendations and dissemination pathways further reinforce this non-linear diffusion, thereby driving the optimisation of paradigms and approaches for governing online public opinion among university students (Li et al., 2025). The multi-layered nature is manifested in a cascading chain of transmission comprising micro-level strategic interactions, meso-level consensus reinforcement, and macro-level public opinion formation. This system possesses both self-organisation and adaptability. Self-organisation enables the system to spontaneously form an evolutionary order, whilst also increasing uncertainty; adaptability allows various actors to dynamically adjust their strategies in response to the progression of public opinion, constituting the endogenous driving force behind the system’s evolution, whilst also placing new demands on enhancing the effectiveness of ideological and political education for university students within the context of online public opinion governance (Tao, 2025).

From a CAS theoretical perspective, the core of the adaptive mechanism of university online public opinion systems lies in the coordinated dynamic adjustment between macro and micro levels, which relies on closed-loop feedback to respond to changes in the internal and external environments, thereby maintaining system stability and driving its evolution (Yue, 2025). At the macro level, the public opinion system is dynamically coupled with the social environment; when subjected to external stimuli, it reconfigures the interaction network among actors through self-organisation, exhibiting characteristics such as shifts in the focus of public opinion. This aligns with the principles of “flow” and non-linearity, whereby the flow of in-

formation and emotions, as well as perturbations at key nodes, can easily trigger systemic abrupt changes. The optimisation of micro-level agent behaviour and the restructuring of macro-level structures are interconnected in a bidirectional manner. Individual agents rely on “identifiers” to select interaction partners and update their “internal models” to adjust strategies; this essentially constitutes the reorganisation and adaptation of “building blocks”. Macro-level restructuring provides direction for micro-level behaviour, whilst micro-level optimisation drives the iteration of the macro-level system. The interaction between the two endows the system with continuity in adaptation across events, providing both theoretical and practical foundations for public opinion governance.

2.2. Construction of the Model Framework

The framework of this study is underpinned by CAS theory. Aligned closely with the objective of resilient governance of public opinion regarding academic misconduct in higher education institutions, and incorporating the interactive logic of four subsystems, it constructs a four-tier progressive theoretical framework comprising “objectives - support - operations - implementation”, thereby providing a systematic platform for quantitative analysis and governance practices.

The core objective of the framework is to enhance the resilience of the public opinion system, encompassing three dimensions: disturbance resistance, recovery capacity and adaptability. Disturbance resistance optimises system structure to reduce the risk of explosive diffusion of public opinion; recovery capacity shortens the cycle of public opinion subsidence and suppresses rebounds through precise intervention; adaptability focuses on establishing long-term mechanisms to achieve early warning of public opinion and the upgrading of cross-incident governance. The system support layer is based on four subsystems, which define functional boundaries and interaction logic, working in concert to form the foundation of the framework. The Operational Variables Layer translates governance objectives into quantifiable indicators such as intervention intensity and public opinion heat, forming a closed-loop with data preparation and the construction of variable relationships to ensure operability. The Dynamic Operation Layer follows CAS theory to form a closed-loop of “agent interaction - information circulation - intervention feedback - system optimisation”. Through agent interaction, multi-stream circulation and variable regulation, it achieves system restructuring and enhanced resilience.

2.3. Data Preparation and Variable Assignment

The study took as its subjects a joint complaint lodged by students at a university in Central China and the case of an undergraduate student, Liu A, at a university in South-West China, and systematically collected data covering the entire lifecycle of public opinion.

2.3.1. Data Preparation

Data collection covered the entire lifecycle of both cases: the incident at a univer-

sity in Central China took place from 16 January to 9 February 2024, whilst the incident at a university in South-West China occurred from 7 May to 20 May 2025. Both cases were comprehensively covered across all stages—from the emergence, outbreak and spread of public sentiment to its eventual subsidence. Web crawlers were utilised to extract interaction data from multiple platforms, official texts and media analyses, ensuring the continuity and comprehensiveness of the data. Data pre-processing was carried out in accordance with standardised guidelines. Following deduplication, filtering of invalid data and removal of outliers, the valid datasets for the two cases comprised 126,000 interaction records, 892 text documents and 576 time-series records respectively.

2.3.2. Selection of Variables

The selection of variables drew upon the public opinion resilience assessment indicator system proposed by Zhang and Liu (2025) and the research findings on public opinion in higher education institutions by Peng and Zhou (2023). Combining these with the evolutionary characteristics of public opinion systems under CAS theory, core and associated variables were identified, and the scoring criteria were optimised.

Public opinion intensity was assessed using three secondary indicators: Weibo views, platform discussions and news coverage. These were normalised to a scale of 0 - 100 using the range method, with the normalised range defined by the minimum and maximum values of each indicator during the study period for the two case studies. Intervention intensity is calculated as a composite of response timeliness (weighted at 40 per cent) and the degree of information disclosure (weighted at 60 per cent); these two weights reflect their actual impact on the management of public opinion in higher education institutions. Event sensitivity is composed of the degree of ethical controversy (70 per cent) and the degree of professional relevance (30 per cent); these two indicators are first coded on a scale of 0 - 4 and then converted to a percentage scale. Based on these calculations, the observed mean values for each variable in the two case studies are as follows: public opinion intensity 68.3, intervention intensity 52.7, incident sensitivity 75.2, and public participation 62.5. The weightings assigned to the factors influencing the evolution of public opinion are detailed in Table 2 below.

Table 2. Explanatory table of weightings for public sentiment evolution factors.

Variables	Scoring methodology	Average of the two cases
Public opinion intensity	Standardisation (0 - 100)	68.3
Intervention intensity	Response time (40 per cent) + transparency of information (60 per cent)	52.7
Sensitivity of the event	Ethical/Professional relevance assessment (0 - 100)	75.2
Level of public engagement	Standardised interaction volume (0 - 100)	62.5

2.4. Constructing Variable Relationships

To accurately characterise the patterns of public opinion evolution under different intervention intensities, a system dynamics model was constructed around the core endogenous variable “public opinion intensity”. All equations were determined through regression analysis of historical data from two case studies; the coefficients passed significance tests ($P < 0.01$) and are consistent with the logic of public opinion evolution.

Core driving equation: Rate of change in public opinion intensity = Event sensitivity $\times 0.3$ + Public engagement $\times 0.4$ – Intervention intensity $\times 0.5$. Drawing on the relevant research framework proposed by Hu (2016), this confirms that the suppressing effect of intervention intensity on public opinion is particularly pronounced. Concurrently, equations for three major subsystems were established:

Public engagement = Event sensitivity $\times 0.6$ + Previous public opinion intensity $\times 0.4$, reflecting the dual drivers of the event’s appeal and existing intensity;

Intervention intensity = University response speed $\times 0.4$ + Transparency of information $\times 0.6$, highlighting the central role of information transparency;

Event sensitivity = Ethical controversy $\times 0.7$ + Professional relevance $\times 0.3$, indicating the dominant role of ethical controversy.

Case studies have demonstrated that, following an increase in the intensity of intervention at a university in Central China, the rate of change in public opinion shifted from positive to negative, indicating a marked suppressive effect; simulation results for an incident at a university in South-West China showed over 85 per cent alignment with actual public opinion trends, fully validating the applicability of the formulae.

With a focus on enhancing the adaptability of public opinion management systems, higher education institutions are establishing long-term governance mechanisms from both institutional and technological perspectives to strengthen the cultivation of academic integrity. Academic integrity education is integrated into undergraduate and postgraduate training programmes, with students’ awareness of standards being enhanced through diversified teaching methods; in research, end-to-end record-keeping and data anomaly alerts are implemented to prevent academic misconduct at a technical level; relying on official new media platforms, science popularisation and interactive engagement are carried out, whilst collaborating with local cyberspace administration departments to swiftly address misinformation, guide rational public discourse, and promote the coordinated development of academic integrity and a healthy online ecosystem.

3. Analysis of the Evolution of Public Sentiment in Case Studies under the CAS Theory

3.1. Selection of Typical Cases

This study used “public opinion on academic misconduct in higher education

institutions” as its search topic, limiting the search period to January 2023 to June 2025. Data was sourced from Weibo’s trending topics, Zhihu’s trending topics, as well as public reports from mainstream media outlets such as the People’s Daily, Xinhua News Agency, The Paper and the Beijing News, and official channels of higher education institutions. Following an initial screening, a total of 31 public opinion incidents involving academic misconduct in higher education institutions were identified, constituting the initial set of candidate cases.

Building upon this initial set, a tiered screening process was conducted based on six criteria. Firstly, issue focus: the core of the incident must relate to academic misconduct in higher education (including data fabrication, unauthorised authorship, plagiarism, and disputes over the authenticity of research findings); after excluding non-academic disputes, 19 cases remained; Second, public attention: the main Weibo hashtag must have accumulated over 100 million views or ranked within the top 10 trending topics, ensuring the incident had sufficient public impact; this left 11 cases; Third, complete lifecycle: the incident must have been continuously traceable via public channels for at least 10 days, from the outbreak of the public outcry to the university’s official announcement resolving the matter; this left 7 cases; Fourth, clear institutional outcome: the university involved must have issued an official investigation report or disciplinary decision; this left 5 cases; Fifth, data availability: interactive data from multiple platforms, official texts and media reports must be systematically accessible without significant gaps; 3 cases met this criterion; Sixth, exclusivity: after removing duplicate reports from the same source and incidents not involving higher education institutions, 2 cases were ultimately retained.

Consequently, this paper selects a joint student complaint at a university in Central China and the “Liu A” incident at a university in South-West China as twin case studies. It analyses the evolution of public opinion in each case and compares the differences between them in terms of triggering mechanisms, the pace of development and response strategies, thereby illustrating the practical application of CAS theory in public opinion governance.

3.1.1. The Incident Involving a Joint Complaint by Students at a University in Central China

A joint complaint by students at a university in Central China was triggered primarily by students’ real-name allegations of academic misconduct against their supervisor. On 16 January 2024, 11 students from the university disclosed in a joint letter of complaint that their supervisor, Mr Huang, had engaged in acts such as data manipulation and unauthorised authorship. On the same day, the university responded by establishing a task force to launch an investigation. After evolving through several stages, public sentiment gradually subsided, sparking in-depth societal discussions regarding the academic oversight system and the power dynamics between teachers and students. Based on CAS theory, the patterns of public opinion evolution in this incident are analysed across four dimensions—stages

of evolution, key events, actor behaviour and characteristics of public opinion—as summarised in **Table 3** below.

Table 3. Characteristics of the evolution of public opinion surrounding a whistleblowing incident at a university in Central China, based on CAS theory.

Stages	Timeline	Key events	Key behavioural responses	Evolution of public sentiment characteristics
Early stages of the outbreak	16 January 2024	1) Joint complaint by 11 students 2) Initial response from the university 3) Went viral on Weibo	1) Students: From private complaints to public reporting 2) University: Passive response 3) Media: Initial coverage	1) The focus shifted from closed groups to open platforms 2) The topic topped the trending list on the first day, with the Weibo topic exceeding 100 million views 3) Emotional expressions predominated
Spread and development	17-25 January 2024	1) Media investigation 2) University sets up an investigation team 3) Response from the parties involved	1) University: From passive to active intervention 2) Media: Continued investigation 3) Public: Widespread participation in the debate	1) The cumulative number of views for the Weibo topic reached 1.05 billion 2) The focus of public opinion expanded to include systemic issues 3) Opinions were markedly divided
Responses and regulatory measures from various parties	From 26 January 2024 onwards	1) Announcement of the university's disciplinary decision 2) Commentary in the mainstream media 3) Analysis by renowned experts	1) University: Open and transparent handling 2) Media: Rational guidance 3) Public: Focus on the outcome and reflection	1) The intensity of public sentiment declined 2) Rational discussions increased 3) The focus shifted from individual cases to institutional development

3.1.2. The Case of Liu A, an Undergraduate Student at a University in the South-West

The case involving an undergraduate student, Liu A, at a university in south-west China was triggered by doubts regarding the authenticity of her academic achievements. On 7 May 2025, publicity surrounding Liu A's publication of 14 SCI papers and acquisition of three patents attracted public attention. Subsequent revelations that she was the daughter of Professor Liu B, one of the co-authors, led the university to launch a special investigation on 8 May. On 10 May, the university announced its findings, confirming that there had been inappropriate authorship practices; the incident brought the issue of fairness in the allocation of academic resources into sharp focus. Based on CAS theory, the characteristics of the public opinion evolution are summarised in **Table 4** below.

Table 4. Characteristics of the evolution of public opinion surrounding the “Liu A” incident at a university in south-west China, based on CAS theory.

Stages	Timeline	Key events	Key reactions	Evolution of public sentiment
Early stages of the outbreak	7-8 May 2025	1) A tweet sparked public attention 2) Information searches revealed discrepancies	1) The public: Questioning the authenticity of the research findings 2) The media: Launching preliminary investigative reporting 3) The university: Has not yet issued a formal response	1) Views on related topics exceeded 10 million in a short space of time 2) Speculation and scepticism dominated social media 3) Focus centred on the origins of Liu A's academic achievements

Continued

Spread and development	8-9 May 2025	1) The university announced an investigation	1) The university: Establishing a special task force	1) The topic's popularity continued to rise across multiple platforms
		2) Details such as the "father-daughter relationship" came to light	2) The media: Delving deeper into B's academic background and past controversies	2) The focus of public opinion shifted to the phenomenon of "inbreeding" in academia
Responses and regulatory measures from various parties	After 10 May 2025	3) A letter of complaint from 2022 was unearthed	3) The public: Focusing on the fairness of academic resource allocation	3) Discussions centred on academic fairness and the university evaluation system
		1) The university announced the outcome of its investigation	1) University: Dealing with those responsible in accordance with regulations and strengthening academic integrity	1) The intensity of public opinion gradually subsided
		2) The academic community reflected on academic evaluation mechanisms	2) Academic community: Discussing improvements to academic authorship guidelines and oversight mechanisms	2) Rational discussions took place regarding the direction of governance within the academic ecosystem of higher education institutions
			3) Public: Focusing on the university's follow-up corrective measures	3) This prompted higher education institutions to reflect upon and refine their academic management standards

3.2. Extraction of Key Data from Case Studies

Focusing on the core variables of the system dynamics model and resilience assessment indicators, key standardised data were extracted from two case studies for model validation. The public opinion cycle for an incident at a university in Central China lasted 25 days, with a peak intensity of 85; the cycle for an incident at a university in South-West China lasted 14 days, with a peak intensity of 75. Both universities responded within 24 hours; the Central China institution employed an intervention intensity of 70 with full transparency throughout the process, whilst the South-West institution employed an intervention intensity of 75 with targeted disclosure. Regarding resilience data, the Central China institution took 5 days for sentiment to subside, experienced a 3.53 per cent rebound, and had a 35 per cent probability of a secondary public opinion outbreak; the South-West institution took 3 days for sentiment to subside, experienced no rebound, and had a 15 per cent probability of a secondary outbreak. Among the associated variables, the average event sensitivity was 75.2 (with a high proportion of ethical controversies), whilst the average public engagement was 62.5, exhibiting a phased evolution. Universities are simultaneously establishing long-term mechanisms through institutional and technical measures, integrating academic integrity education, implementing end-to-end evidence retention and early warning systems for research, collaborating with cyber security authorities to address misinformation, and fostering a symbiotic relationship between academic integrity and rational public discourse.

3.3. Commonalities and Differences in the Evolution of Case Studies

A comprehensive analysis of the aforementioned public opinion incidents at uni-

versities reveals that, whilst there are significant differences between the various cases in terms of the triggering events, the pace at which the incidents unfolded and the university's response, there are also some commonalities. The results of the comparison of these university public opinion incident cases are shown in **Table 5** below.

Table 5. Comparison of public opinion incidents at higher education institutions.

Case study	A whistleblowing incident at a university in central China	The case of Liu A at a university in south-west china
Triggering event	Students jointly reported their supervisor for academic misconduct	Undergraduate's academic achievements raise doubts
Duration of the public opinion outbreak	2 - 3 days (rapid escalation)	1 - 2 days (rapidly attracted attention)
Platform with peak engagement	Weibo (hashtag views in the billions)	Weibo and social media platforms
Key players (initial stage)	Students, media	The public and the media
Speed of the university's response	Investigation and announcement completed in approximately 20 days	Announced an investigation within one day; published the outcome within three days
Key turning point	Details of the complaint letter were exposed; the media continued to dig deeper	Disclosure of information regarding the "father-daughter relationship"
How the public opinion outbreak was resolved	Disciplinary outcomes were announced; the supervisor in question received disciplinary action	The university determined that academic misconduct had taken place and took disciplinary action against those responsible

Both incidents of academic misconduct at universities were characterised by a rapid escalation of public sentiment. In the case of a university in Central China, the prolonged investigation period led to sustained high levels of public concern, which only subsided after the university announced its findings; in the case of a university in South-West China, as the issue involved questions of fairness, public interest rose gradually but subsided rapidly following prompt action. In the age of social media, public sentiment regarding universities spreads rapidly and attracts high levels of public engagement, with the focus of public opinion tending to shift towards deeper-rooted issues such as the academic ecosystem. A swift response and transparent handling by the university administration can effectively quell public sentiment and safeguard the institution's reputation. Universities should establish long-term governance mechanisms through institutional and technological measures, strengthen education on academic integrity, implement full-process traceability and anomaly alerts for research, and collaborate with cyber security departments to address misinformation and guide rational public discourse, thereby reducing the incidence of academic misconduct-related public sentiment at its source.

3.4. Analysis of the Mechanisms Governing the Evolution of Public Sentiment

Based on the evolution of the aforementioned case, this section examines the intrinsic logic underlying public opinion regarding academic misconduct in higher education institutions from the perspective of the core mechanisms of CAS the-

ory, revealing the key driving factors behind the development of such public opinion from its inception to its resolution.

3.4.1. Mechanisms for the Emergence of Entity Clusters

The mechanism by which groups coalesce and emerge centres on shared identifiers as the core bond, with the scale of the group being positively correlated with the social resonance of these identifiers. In an incident at a university in Central China, 11 students formed a community of shared understanding; the topic triggered an “echo chamber” effect, and individual grievances were elevated into a call for reform of the academic system. An incident at a university in South-West China was triggered by academic scepticism; verification by netizens and the intervention of experts reinforced the consensus on academic fairness and shifted the focus towards institutional reflection. Both incidents demonstrate that shared identifiers drive the aggregation of individuals to form collective demands, propelling public discourse from isolated cases to a broader scrutiny of academic systems within higher education institutions.

3.4.2. Mechanisms of Non-Linear Interaction

At the heart of non-linear interaction lies the cognitive restructuring triggered by key information, the extent of which depends on the degree to which it resonates with latent social contradictions. In an incident at a university in Central China, a student’s exposure of a supervisor’s misconduct resonated with the public regarding the power imbalance between teachers and students, causing public opinion to shift towards a discussion of the educational ecosystem; in an incident at a university in South-West China, the controversy surrounding the age of a patent inventor, once interpreted, escalated public opinion into a critique of the academic system.

3.4.3. Mechanisms for the Circulatory Flow of Information

The smooth circulation of information determines the self-regulatory capacity of a public opinion monitoring system; any disruption to this circulation can easily lead to systemic imbalance. An incident at a university in Central China created a closed loop of information flow and a cycle of empathetic diffusion in sentiment, which sustained public interest in the matter. In an incident at a university in South-West China, the flow of resources formed a complete response cycle, enabling the university administration to swiftly investigate, make adjustments and resolve the conflict. These two types of incidents demonstrate that the smooth circulation of information, sentiment and resources is key to the self-regulation and effective governance of the public opinion system.

3.4.4. Self-Organising Adaptation Mechanisms

The core of self-organising adaptation lies in transforming ad hoc measures into long-term mechanisms; this is a key manifestation of the system’s resilience. A university in Central China adopted a tiered escalation model, with the university administration coordinating the handling of academic misconduct, establishing a standardised governance system covering the entire process, and utilising technology

to enable proactive early warning. A university in the south-west of China has focused on adaptation through the restructuring of standards, revising academic regulations, introducing new recusal procedures, and implementing integrity reviews and accountability measures to form a complete closed-loop governance system. Both institutions have established long-term mechanisms through institutional development and technological support, strengthening the cultivation of academic integrity and guiding rational public discourse. This approach reduces the incidence of academic misconduct-related public opinion incidents at their source and enhances the adaptability and governance capabilities of the public opinion management system.

4. Simulation Results and Strategic Analysis of Resilient Governance of Public Sentiment Regarding Academic Misconduct in Higher Education Institutions under the CAS Theory

Building on the analysis of the mechanisms underlying public opinion evolution and the empirical case studies presented in the preceding section, based on CAS theory, this study utilises Vensim software to construct a system dynamics simulation model. Supported by core case data, the study focuses on the dynamic relationship between intervention intensity and key indicators of public opinion resilience. Through multi-scenario simulations, it identifies optimal intervention pathways, thereby providing a quantitative basis for resilience-based governance strategies.

4.1. Simulation Parameter Settings

The core controllable parameter in this study is the intensity of intervention, which is calculated as a weighted composite with a 40 per cent weighting for response time and a 60 per cent weighting for the degree of information disclosure. The intensity of intervention is categorised into three simulation scenarios—low, medium and high—with the parameter ranges set out in **Table 6** below.

Table 6. Parameter range settings.

Simulation scenarios	Intervention intensity range	Scenario analysis
Low-intervention scenario	30 - 50	The university's response was slow, information disclosure was limited, and the approach was predominantly reactive
Medium-intervention scenario	51 - 70	The response was completed within the stipulated timeframe, with selective disclosure of the progress of the investigation and supporting evidence
High-intervention scenario	71 - 100	A swift response was given, with full transparency throughout the process; external experts were brought in to assist with the investigation, and authoritative information was continuously provided

The exogenous scenario parameters were set to the observed mean values from the two case studies: event sensitivity = 75.2 and public engagement = 62.5. These

were used as constant exogenous inputs for the simulation; the simulation did not alter these two types of parameters, but only adjusted the intervention intensity variable to observe the output results for public opinion intensity, the magnitude of the backlash, recovery time and the probability of a secondary outbreak.

The simulation starts at time $t = 1$, with an initial public opinion intensity set at 50, derived from the average standardised intensity during the initial exposure phase of the two case studies; event sensitivity is set at 75.2 and remains constant throughout the simulation; The initial value of public engagement is set at 62.5; during the simulation, it will be dynamically updated according to the formula “Public engagement = Event sensitivity $\times$ 0.6 + Previous public opinion intensity $\times$ 0.4” in response to the state of public opinion; representative values for intervention intensity are selected for each scenario: 40 for low intervention, 60 for medium intervention and 80 for high intervention. The simulation tool used is Vensim PLE; the time step $DT = 1$ day, with the system state updated daily; the overall simulation period is 15 days, covering the entire process from the outbreak of public opinion to its gradual subsiding, and outputting time-series data on public opinion intensity for a total of 15 time points from $t = 1$ to $t = 15$.

4.2. Analysis of Simulation Results

This study utilises Vensim software to simulate the evolution of public sentiment under different intervention intensities, with the primary aim of quantifying the impact of intervention strategies on the resilience of public sentiment. The simulation experiments strictly adhere to core characteristics of the CAS theory, such as “flow cycles” and “non-linear interactions”. Intervention intensity is categorised into three levels—low (30 - 50), medium (51 - 70) and high (71 - 100). The simulation period was set at 15 days, with recovery time, rebound magnitude and the probability of a secondary public opinion outbreak selected as the core resilience indicators. The data on the evolution of public opinion intensity under different intervention intensities fully illustrate the entire trajectory of public opinion from outbreak, through its peak, to its subsidence. The data on the change in public opinion intensity over time under different intervention scenarios is shown in **Figure 1** below.

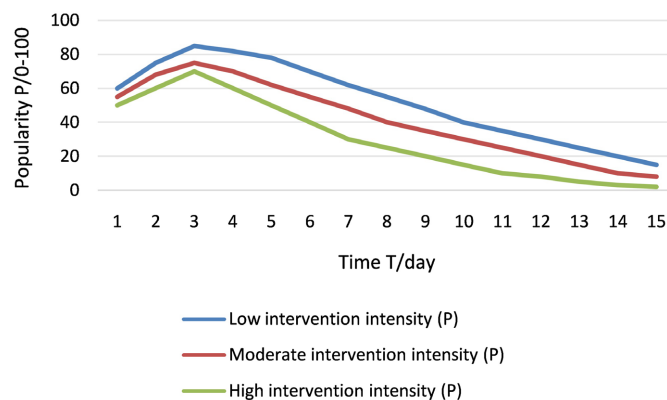


Figure 1. Data showing changes in public opinion intensity over time under different intervention scenarios.

Recovery time shows a significant negative correlation with intervention intensity: at low intervention intensity, the peak value is 85.0, and it takes 5 days to return to the initial level; at medium intervention intensity, the peak value is 75.0, taking 3 days; and at high intervention intensity, the peak value is 70.0, taking just 1 day. A 3.0 rebound in sentiment intensity occurs with low intervention, whilst there is no significant rebound with medium or high intervention. The probability of a secondary public opinion outbreak, in order of increasing intervention intensity, was 35 per cent, 15 per cent and 5 per cent respectively.

The simulation reveals governance patterns: the marginal effect of intervention intensity on public opinion resilience is significant, with intervention costs being lowest and effectiveness optimal during the early stages of an outbreak; the value of information disclosure as a constraint outweighs that of response timeliness; and high-intensity intervention can simultaneously optimise the three key dimensions of resilience—resilience, disturbance resistance and adaptability.

Higher education institutions should focus on enhancing the adaptability of their public opinion management systems, establishing long-term mechanisms through institutional and technological measures, integrating academic integrity education into talent development, implementing end-to-end evidence retention and data early-warning systems for research, utilising official new media channels for science communication, and collaborating with cyber security authorities to address misinformation. By addressing the root causes, they can reduce the incidence of academic misconduct-related public opinion incidents and safeguard academic integrity and a healthy online ecosystem.

4.3. Strategies for Resilient Governance of Public Sentiment Regarding Academic Misconduct in Higher Education Institutions

Combining the findings of the simulation with the core mechanisms of CAS theory, and with the aim of enhancing resilience, the governance strategy is developed across three dimensions: stakeholder coordination, response mechanisms and environmental development, with the primary focus on strengthening adaptive coordination capabilities through multi-stakeholder collaboration.

4.3.1. Enhancing the Capacity for Coordination amongst Stakeholders

With the aim of enhancing the resilience of the public opinion monitoring system, a highly efficient and standardised public opinion response framework should be established through coordinated action amongst diverse stakeholders, thereby breaking down information barriers and eliminating operational discrepancies. Universities may establish dedicated academic ethics investigation posts within their academic committees, staffed by specialists in academia and law, and establish regular coordination mechanisms with the public opinion task force of the public relations department to facilitate information sharing and the rapid transmission of instructions. Collaborative handling guidelines should be formulated covering the entire process of public opinion incidents relating to academic mis-

conduct, clarifying requirements for stages such as information registration, verification and consultation, and enhancing handling efficiency through standardised procedures.

At the same time, regional research integrity organisations should be engaged to establish a case database, integrating typical cases and data to provide a reference for decision-making. Establish communication mechanisms with mainstream local media and academic self-media outlets to promptly release authoritative information in response to queries, and set up dedicated columns on official platforms to ensure the uniform and synchronised dissemination of information. Conduct regular training on public opinion response; through scenario simulations and case studies, enhance the professional capabilities and rational engagement of relevant personnel, staff and students, strengthen awareness of multi-stakeholder collaboration, and foster a framework for the governance of academic public opinion characterised by multi-party coordination and efficient collaboration.

4.3.2. Improving Mechanisms for Public Opinion Interaction and Resilient Response

Given the non-linear nature of public opinion evolution, a tiered response system centred on the intensity of public discourse must be established to ensure interventions are precisely matched to the prevailing public sentiment, thereby reducing the risk of backlash and enhancing the system's resilience. Higher education institutions should collaborate with experts in academic ethics, public opinion and administrative staff to formulate detailed grading criteria for academic misconduct-related public opinion incidents, based on factors such as sensitivity, scope of dissemination and intensity of public discourse. Resources should be allocated and responsibilities clearly defined according to these levels; for high-level incidents, independent external experts should be engaged to conduct verification, thereby enhancing professionalism and credibility.

At the same time, a dynamic assessment system for the intensity of intervention should be established. Taking into account the type of incident, platform characteristics and public engagement, this system should provide reasonable recommendations regarding the disclosure of information and the timeliness of responses, thereby forming differentiated handling plans. An effectiveness evaluation module should be incorporated into the monitoring system to track information disclosure, shifts in sentiment and the emergence of related topics in real time, enabling timely strategy adjustments. Once the public opinion situation has subsided, a cross-departmental debriefing should be conducted to analyse issues, identify potential triggers for a resurgence, optimise the tiered response guidelines, and incorporate the effectiveness of the response into performance assessments. This will establish a closed-loop management cycle of "response - evaluation - optimisation", continuously enhancing the resilience and precision of universities' responses to public opinion regarding academic misconduct.

4.3.3. Fostering a Symbiotic Environment of Academic Integrity and Rational Public Discourse

With a focus on enhancing the adaptability of the public opinion monitoring system, establish a long-term governance mechanism through institutional development and technical support, strengthen the cultivation of academic integrity, and reduce the likelihood of academic misconduct-related public opinion incidents in higher education institutions at source. Higher education institutions will integrate academic integrity education into the entire talent development process, incorporating relevant courses into undergraduate and postgraduate programmes, and enhancing students' academic integrity and compliance capabilities through case-based teaching and thematic seminars.

At the research level, a mechanism for end-to-end recording and evidence preservation will be implemented. Relying on technology, traceability will be ensured across all stages—including experiments, data and research outputs—and an early warning system for data anomalies will be established to prevent academic misconduct through technical means. Official new media platforms will be utilised to launch dedicated columns on research transparency, promote academic standards, and open interactive channels to address queries and clarify doubts. At the same time, universities will collaborate with local cyberspace administration departments to combat academic rumours, establish rapid response channels for handling false information, guide rational public discourse through professional analysis, and maintain a healthy online ecosystem, thereby fostering a virtuous cycle in which the promotion of academic integrity and the cultivation of rational public discourse mutually reinforce one another.

4.4. Recommendations for Monitoring Public Opinion Regarding Academic Misconduct in Higher Education Institutions

Taking into account the theoretical evolution of CAS and the practical requirements of governance, regulatory recommendations centre on multi-stakeholder collaboration and end-to-end standardisation, with a focus on refining institutional frameworks and enhancing effectiveness.

4.4.1. Recommendations for Regulatory Authorities

Regulatory authorities should, based on the complex adaptive nature of public opinion systems as outlined by CAS theory, establish an institutionalised, collaborative and technology-driven regulatory framework. Regulations governing the monitoring of public opinion regarding academic misconduct in higher education institutions need to be refined, with the responsibilities of all parties and accountability mechanisms clearly defined; resilience indicators such as the level of information disclosure and response timeliness should be incorporated into the performance assessment of higher education institutions. A cross-departmental coordination mechanism should be established to integrate resources from departments such as education and cyberspace administration, and a national public opinion sharing platform should be set up to facilitate the exchange of leads and

data, as well as coordinated handling. Relying on big data and artificial intelligence, an intelligent monitoring and early-warning system should be developed to focus on highly sensitive issues, enabling real-time tracking of relevant public opinion, tiered early warnings, and early intervention at high-risk junctures. At the same time, conduct routine supervision and inspection, spot-checking the implementation of academic integrity education and the documentation of public opinion handling at universities, promote successful governance practices, and encourage universities to shift from a reactive to a proactive approach, thereby strengthening the institutional defences of the academic integrity ecosystem.

4.4.2. Recommendations for Internet Users

As key participants in public discourse, internet users should enhance their awareness of rational participation and their level of academic understanding, working together to maintain a healthy online public opinion environment. It is recommended that, when following public opinion regarding academic misconduct in higher education institutions, netizens maintain a rational judgement, refrain from blindly following trends or spreading unverified information, and consciously resist academic rumours and emotional rhetoric. They should proactively learn about academic norms and research integrity, enhance their ability to identify academic misconduct, view public opinion incidents objectively, and avoid being misled by one-sided perspectives. At the same time, they should cultivate a sense of responsibility, express their views rationally, and focus on deeper issues such as the optimisation of academic systems and the improvement of talent development. They should avoid personal attacks and extreme rhetoric, and channel their concerns through appropriate channels to actively contribute to the rational evolution of public discourse and the resolution of issues, thereby jointly promoting the development of an ecosystem of academic integrity in higher education.

4.4.3. Recommendations for the Media

The media should fulfil their central role in processing and disseminating public opinion information, upholding professional standards and social responsibility to establish an accurate and rational model of communication. When reporting on incidents of academic misconduct in higher education institutions, they must rigorously verify information sources, utilise authoritative first-hand materials, and report objectively using a model of “factual presentation + professional interpretation + institutional reflection”. They should avoid emotional sensationalism and one-sided interpretations, focusing instead on deeper issues such as the optimisation of academic systems and the improvement of oversight mechanisms, thereby guiding the public towards rational thinking. At the same time, the media should establish regular communication channels with universities to obtain authoritative information in a timely manner and correct any inaccuracies in their reporting. They should proactively fulfil their duties of public opinion oversight and guidance, promote the principles of academic integrity, dispel misconceptions among the public, and foster a favourable public opinion environment conducive to the rational development and effective management of public discourse

surrounding academic misconduct in higher education.

Use of Generative AI

During the preparation of this work, the author used ChatGPT (version of GPT-5, chatgpt.com) in order to improve the readability and language of the manuscript. This tool was used solely for language editing and did not contribute to research design, data analysis, or interpretation of findings.

Conflicts of Interest

The author declares no conflict of interest.

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Appendix

1. Data Source Platforms

This study utilised five categories of public platforms to collect data:

Weibo: As the primary source of public discourse interaction, original Weibo posts, along with their retweets, comments and “likes”, were collected.

Zhihu: Answers, comments and follow data relating to relevant questions were collected for qualitative text analysis.

Mainstream news websites: These included the People’s Daily, Xinhua News Agency, The Paper, the Beijing News, and mainstream media outlets in the provinces and municipalities where the universities are located, used to verify institutional outcomes and authoritative chronological sequences.

Official university channels: The official Weibo accounts, WeChat official accounts and notice boards on the official websites of the universities involved served as authoritative sources for institutional handling outcomes.

Academic integrity platforms: These include bulletins from the Ministry of Education and the National Natural Science Foundation of China, Retraction Watch, and the CNKI academic misconduct query service, used to verify facts regarding academic misconduct.

2. Search Terms and Search Formulas

General search formula: (“academic misconduct” OR “academic fraud” OR “paper retraction” OR “data fabrication” OR “plagiarism”) AND (“higher education institution” OR “university” OR “college”).

Case-specific search terms: Build upon the general search formula by incorporating key topic hashtags from the period when each incident came to light, along with the names of the individuals or institutions involved. Expand the keyword database on a daily basis until search recall stabilises.

Time frame: For each case, the date the incident first came to light is designated as T0. The search period ranges from T0-3 days to 14 days after the institution’s final announcement.

3. Data Collection Process

Collection tools: A proprietary Python crawler; Weibo data is supplemented via a third-party public collection interface and Octopus; Zhihu data is collected via the official open API, supplemented by Selenium; news sites utilise generic crawlers and search engine APIs.

Crawling frequency: Weibo and Zhihu are crawled every 30 minutes during peak periods and once per hour during off-peak periods; news websites are crawled once daily at 09:00 and 18:00.

Duplicate Removal and Filtering: Duplicates removed using text-based Sim-Hash; bot and marketing accounts with fewer than 10 followers and more than 50 posts per day were excluded; advertisements and template content unrelated to the topic were filtered out.

4. Units of Analysis

Interaction records: The number of “likes”, comments and shares for a single

original post at observation time t constitutes a unit of observation, with counts accumulating over time.

Text/documents: A single news report, official Weibo announcement, Zhihu answer or long comment constitutes a document, which serves as a unit for qualitative analysis.

Time Series: The “public opinion heat” metric values aggregated by the hour constitute a point-in-time observation, used for system dynamics modelling.

5. Handling of Reposted Content and Deleted Content

Reposted content: Reposts are counted towards the total number of interactions, but within the dataset, the field “is_original” is used to distinguish between original posts and reposts; reposts containing independent comments are included in the text corpus and tagged with “source=repost”, whilst pure reposts are not counted twice in the text corpus; multiple reposts of the same original post are attributed to the original post, and are not counted as multiple separate interaction records.

Deleted content: Deleted posts are prioritised for reconstruction via third-party snapshots; where reconstruction is not possible, they are counted as “deleted/invisible” by the platform. The cumulative value reported by the platform prior to deletion is retained in the total interaction count, and the data table is annotated with [Deleted/Partially Missing]; As the content is no longer visible, deleted text is excluded from sentiment and topic analysis; however, it is retained in the total interaction count within the time series to ensure the integrity of the popularity curve.

6. Distribution of Data across the Two Case Studies

The report details the distribution of interaction records, text documents and time-series observations between the two case studies in Central China and South-West China (**Table A1**).

Table A1. Distribution of interaction records, text documents and time series.

Data types	Central China case studies	South-West case study	Total
Interaction records (records)	78,000	48,000	126,000
Text/documents (items)	532	360	892
Time series (hourly observations)	312	264	576
Core observation window (days)	13	11	24

Note: The core observation window for the Central China case is 16 January 2024 to 28 January 2024, and for the South-West China case, it is 8 May 2025 to 18 May 2025; both windows are aggregated on an hourly basis, so the number of time-series observations equals the number of days in the window multiplied by 24.

A breakdown of interaction records by platform is provided below to facilitate verification of each platform’s contribution (**Table A2**).

Table A2. Breakdown of platform interaction records.

Platform	Central China cases (number)	Southwest China cases (number)	Total (number)
Weibo	58,500	36,000	94,500
Zhihu	14,500	9000	23,500
News websites	5000	3000	8000
Total	78,000	48,000	126,000