

BERTopic-Based Public Opinion Topic Mining on Graduate Supervisors: A Case Study of Weibo

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Abstract: Weibo public opinion on graduate advisor issues profoundly reflects the structural contradiction between institutional supply and student demands. This study conducted dynamic topic modeling on 187,238 relevant posts from 2017 to 2024 using the BERTopic model, revealing three core findings. First, the topic distribution exhibits significant dual-track differentiation: academic routines and student mutual aid constitute a stable public opinion baseline, accounting for over 70% of the corpus, with high-frequency terms such as "thesis" and "graduation" indicating resource competition pressures under the expansion of enrollment policies, while the "outbreak-plunge" pulse pattern of extreme events confirms the short-term nature of public opinion. Second, policy interventions follow a clear three-stage response path; after the issuance of the Guidelines for Advisor Conduct in 2020, the symbolic phase of policy communication and the lagged accountability phase of institutional implementation highlight the risk of "symbolic governance." Third, cross-topic analysis further exposes systemic contradictions: the infiltration of academic pressure into regional resource issues reveals inter-institutional resource imbalances, and although the symbolic dissemination of extreme events prompts institutional reflection, it remains constrained by issue fragmentation. The theoretical contribution of this study lies in quantitatively verifying the correlations among higher education expansion, institutional change, and public opinion evolution. Its practical significance lies in providing data support for constructing an early-warning mechanism for advisor-student conflicts and optimizing the advisor authority checklist, while also innovatively confirming the effectiveness of BERTopic in short-text public opinion modeling, thereby promoting a shift in educational governance paradigms from passive response to active intervention.

Keywords: Graduate Supervisor, BERTopic, Dynamic Public Opinion.

1. Introduction

A sound supervisor–graduate student relationship is the core foundation for high-quality talent cultivation [1]. In recent years, as China's postgraduate enrollment has continued to expand, the role of supervisors has evolved from the traditional knowledge transmitter to a multifaceted composite of academic leader, career planner, and psychological counselor, and their supervisory behaviors directly affect the quality of training and the health of the academic ecosystem [2]. However, in stark contrast to this importance, a large number of one-sided and negative reports in the media have obscured the true nature of the supervisor–student relationship, not only exacerbating public cognitive bias but also reflecting the deep-seated tensions between institutional discipline and humanistic care, as well as between research performance and the essence of education, within the traditional master-apprentice system [3].

To transcend the limitations of fragmented information, this study systematically analyzes the issue structure and dynamic evolution of public opinion related to "graduate supervisors" on the Weibo platform from the perspective of students. As China's largest open public opinion platform, Weibo features user-generated content with high authenticity, strong timeliness, and diverse topics, providing a unique window for spontaneous student voices [4]. This study retrieves 187,238 relevant posts from 2017 to 2024, covering critical periods of policy adjustments and public opinion outbreaks. Leveraging the platform's unique "retweet-comment" diffusion mechanism, we capture the collective memory and value judgments of the public regarding supervisor–student relationships [5], thereby providing data support to overcome the static limitations of

traditional questionnaire surveys.

Methodologically, this study innovatively introduces the BERTopic model, combining pre-trained language models with hierarchical density-based clustering, to achieve a comprehensive multidimensional analysis of educational public opinion—from semantic deconstruction to spatiotemporal evolution. Through topic mining and evolutionary analysis, we focus on revealing the influence mechanisms of policy interventions, social events, and institutional environments on public opinion evolution, and we quantitatively present the associations between phenomena and issues within the topic structure. The significance of this study is twofold: on the one hand, through long-term, large-scale time-series data tracking, we uncover the structural contradictions and underlying demands reflected in public opinion; on the other hand, we provide empirical evidence for constructing harmonious supervisor–student relationships and offer methodological references for educational public opinion management.

2. Literature Review

Research on supervisor–student relationships has gradually shifted from early explorations of ideal models to a focus on their complexity, dynamics, and practical challenges. The academic community generally recognizes that the supervisor–student relationship has transcended traditional knowledge transmission and evolved into a multidimensional composite encompassing academic guidance, emotional support, economic interests, ethical norms, and career development, with its quality directly affecting postgraduate training outcomes, mental health, and the health of the academic ecosystem [6]. In practice, however, this relationship faces the core challenge of ambiguous rights and

responsibilities. At the policy level, although supervisors are emphasized as the "primary responsible person," there remains a lack of clear delineation of power boundaries and student rights. Meanwhile, supervisors and students hold significantly different role expectations—supervisors may prioritize academic output and project completion, while students expect greater academic autonomy, psychological care, and fair returns. This cognitive misalignment can easily lead to the alienation of the relationship into forms such as "clannish," "apprentice-style," or "employee-style" patterns [7].

In exploring the influencing factors, scholars have generally analyzed them from three dimensions: institutional environment, individual characteristics, and interactive processes [8]. At the institutional level, the supervisor-responsibility system grants supervisors dominant authority but lacks effective oversight and checks and balances. Coupled with an evaluation system that emphasizes research performance, this may indirectly incline the relationship toward utilitarianism [9]. At the individual level, factors such as supervisors' mentoring styles and academic status, as well as students' academic self-discipline and communication proactivity, all affect relationship quality [10]. At the interactive process level, communication frequency, content, and conflict-resolution mechanisms collectively shape the daily dynamics of the relationship [11]. It is worth noting that social media platforms provide students with new channels for authentic expression, but they may also amplify negative public opinion, further complicating public perception.

To construct harmonious supervisor–student relationships, researchers have proposed multi-level strategies. At the micro-relational level, it is necessary to strengthen communication, clarify expectations, and facilitate a shift from "responsibility for" to "responsibility with" relationships [12]. At the meso-institutional level, clear supervisor responsibility checklists, student rights appeal mechanisms, and collective supervisory group models should be established [13]. At the macro-policy level, it is essential to improve supervisor selection, training, and evaluation systems by incorporating soft indicators such as humanistic care and mentoring investment into assessments, thereby guiding the supervisor–student relationship back to its educational essence [14].

In terms of research methods, early studies predominantly employed small-scale interviews or case analyses, which, despite their capacity for in-depth exploration of individual experiences and relational logic, suffered from limited sample representativeness and generalizability. In recent years, large-sample questionnaire surveys have become mainstream, capable of revealing overall trends such as cognitive asymmetries through cross-perspective comparisons, but they remain insufficient for capturing deep-seated motivations and dynamic processes [15]. With the development of big data technologies, analyses based on social media texts have been introduced. Their advantages lie in accessing massive, authentic, and highly time-sensitive student self-expressions, offering new perspectives for understanding collective emotions and structural contradictions in public opinion. However, they also face challenges such as information fragmentation and accuracy in sentiment judgment. Therefore, future research trends favor methodological integration, combining the breadth of quantitative data with the depth of qualitative research, while incorporating longitudinal tracking designs to more comprehensively and dynamically

reveal the full complexity of supervisor–student relationships.

Against this methodological evolution, the present study adopts BERTopic-based topic modeling, which offers advantages over traditional methods such as LDA in terms of semantic understanding and dynamic tracking [16]. Built on pre-trained language models, BERTopic generates context-aware semantic vectors, accurately capturing the authentic meanings of expressions such as "supervisor pressure" and "hands-off mentoring" within specific contexts, thereby effectively identifying alienated forms in supervisor–student relationships [17]. Its density-based clustering algorithm does not require pre-specifying the number of topics, can automatically identify topic structures, and supports temporal dynamic tracking, making it suitable for capturing the evolution of public opinion following policy changes or events. Meanwhile, its c-TF-IDF keyword extraction mechanism enhances topic interpretability and effectively aggregates fragmented student demands in short texts on social media, thus overcoming the limitations of traditional methods in semantic ambiguity, rigid topic assumptions, and short-text sparsity, providing methodological support for revealing structural contradictions and evolutionary dynamics in supervisor–student relationships from large-scale public opinion data [18].

In summary, research on supervisor–student relationships has progressed from theoretical speculation to empirical analysis, and from unidirectional description to bidirectional interactive perspectives. Future research, by further integrating multidisciplinary perspectives, combining dynamic and longitudinal data, and paying attention to the impacts of emerging interactive platforms, is expected to provide more robust support for both the theory and practice of supervisor–student relationships.

3. Technical Route

This study employs the BERTopic model to perform cluster analysis on Weibo texts containing the keyword "graduate supervisor."

3.1. Principle and Suitability of BERTopic

BERTopic is a deep learning-based topic mining model that uses pre-trained Transformer models and the c-TF-IDF procedure to generate cluster embedding methods with extended topic representations [19]. Compared with traditional topic models, BERTopic integrates the advantages of deep learning and statistical methods, forming a complete pipeline from text input to topic output, which significantly improves clustering accuracy and interpretability while maintaining semantic coherence, as shown in Figure 1.

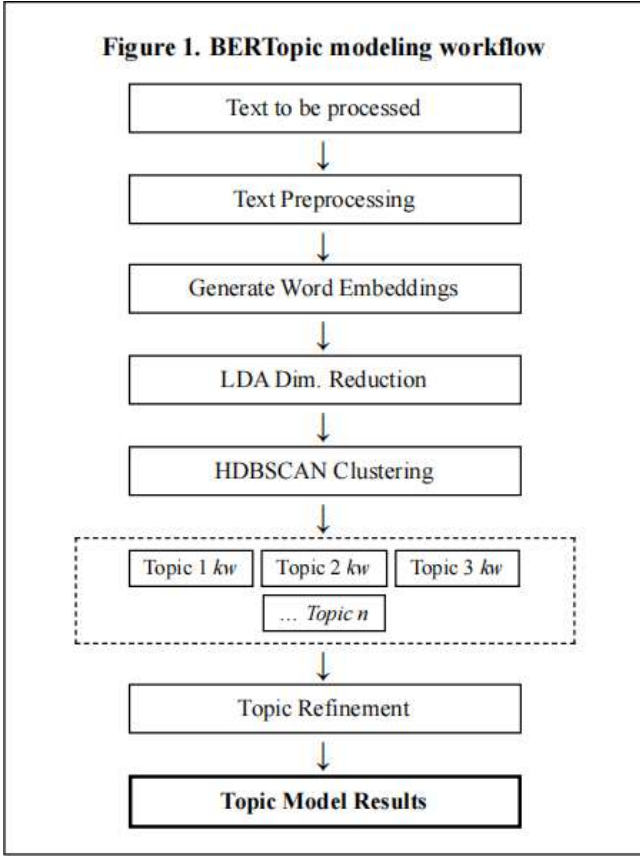


Figure 1. BERTopic workflow

Topic modeling with BERTopic follows six steps: text preprocessing, generating word embedding vectors, UMAP dimensionality reduction, HDBSCAN clustering, topic keyword extraction, and topic refinement.

$$W_{t,c} = tf_{t,c} \cdot \log \left(1 + \frac{A}{tf_t} \right)$$

3.2. Research Design

(1) Data Preprocessing

Due to the technical constraint of BERT's 512-token length limit, a sentence-splitting strategy is adopted to decompose long texts into shorter units that meet the input requirements; otherwise, the excess portion would be truncated, potentially affecting the topic identification results.

(2) Topic Identification

A multi-layer topic analysis model is constructed based on the BERTopic framework. First, the bert-base-chinese pre-trained model is used for deep semantic encoding to generate high-dimensional document vector matrices. Subsequently, the UMAP algorithm is applied to reduce vector dimensionality, and the HDBSCAN density-based clustering algorithm is combined to obtain semantically similar document clusters. At the topic representation level, a class-TF-IDF algorithm is employed to extract core keywords for each topic. Through analysis of the document–topic probability matrix, the topic category to which each document belongs is determined. Finally, visualization techniques are used to present the multidimensional relationships among topic distributions, document clusters, and keyword associations in a three-dimensional manner.

Regarding parameter selection in this study, UMAP uses the default value of $n_neighbors = 15$; to achieve more

compact clustering of the large dataset, min_dist is set to a relatively small value of 0.01^[20]. Since the total number of posts after preprocessing exceeds 180,000, the $min_cluster_size$ parameter of HDBSCAN is set to 1,000, and $min_samples$ is set to 2, in order to avoid an excessive number of noise points affecting the results^[21].

(3) Result Analysis

Based on the output of the BERTopic model, an in-depth analysis is conducted from various visualization perspectives^[17]. Horizontally, the similarities and differences in topic distributions and topic clustering are analyzed from an overall perspective. Vertically, the evolutionary trends of each topic over time are examined, along with projections of possible future developments.

4. Data Sources

4.1. Data Collection

This study conducted structured data collection on the Sina Weibo social platform using a Python web crawler system. The data collection period spanned from January 1, 2017, to December 31, 2024. Using "graduate supervisor" as the search keyword, we established a multi-dimensional data acquisition framework and initially obtained 214,255 valid posts.

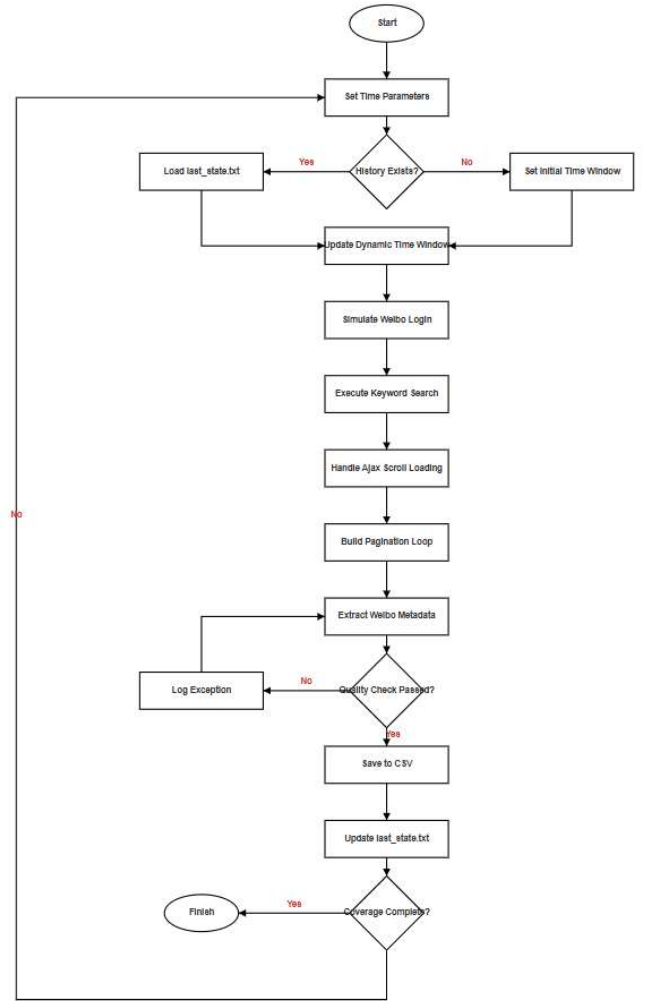


Figure 2. Data acquisition flowchart

4.2. Data Preprocessing

First, post content and timestamp information were extracted from the original CSV files and stored in TXT files.

Data deduplication was performed using Python scripts. To ensure domain relevance, a pre-trained model was applied to filter valid texts containing the semantic features of "graduate supervisor," while simultaneously removing noise such as advertisements and hyperlinks. At the text structuring stage, Jieba segmentation was employed in conjunction with a custom education-domain dictionary, and an extended stopword list was used to filter out meaningless generic words and region-specific terms. To address the technical constraint of BERT's 512-token length limit, a sentence-splitting strategy was adopted to decompose long texts into shorter units that meet input requirements, ultimately yielding 187,238 valid structured data records.

4.3. Data Overview

After cleaning, the total number of valid posts in this study was 187,238. The temporal distribution characteristics are presented through two-dimensional visualizations. The time-slot distribution chart reveals periodic patterns in posting volume: the low-activity period occurs during nighttime hours (00:00–08:00), with only 5,817 posts, consistent with the daily routines of the student population. The high-activity intervals exhibit a bimodal pattern during the morning (09:00–11:00) and afternoon (14:00–17:00), reaching 20,477 and 28,341 posts respectively, reflecting the concentrated daytime discussions within the academic community. The 24-hour trend chart further reveals fluctuations in posting volume, with the daily peak occurring at 10:00 (13,049 posts), closely aligning with break times and morning dissemination of opinion events. Secondary peaks appear at 15:00 (9,872 posts) and 21:00 (8,643 posts), reflecting users' renewed participation during rest periods and after class. The trough occurs during the early morning hours of 03:00–05:00, representing the lowest point of the day.



Figure 3. 24-hour temporal distribution of graduate supervisor-related posts

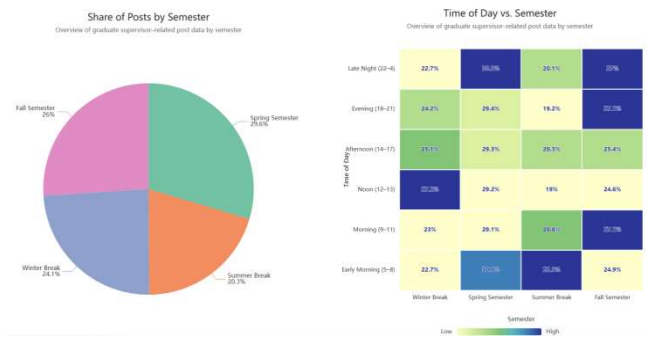


Figure 4. Overview of graduate supervisor-related post data by semester

The fall and spring semesters constitute the core discussion periods, accounting for 30.9% (57,858 posts) and 30.4%

(56,928 posts) respectively, collectively exceeding 60% of the total volume. This indicates a high degree of synchronization between graduate supervisor-related topics and the academic semester system. The summer vacation maintains a significant share of discussion volume (24.1%, 45,136 posts), corroborating the sustained driving effect of continuous activities such as laboratory work and paper submissions on public opinion. The winter break accounts for the lowest proportion (14.6%, 27,336 posts), reflecting the weakening effect of family reunification on public engagement with the topic.

5. Topic Model Analysis based on BERTopic

5.1. Model Overview and Topic Interpretation

5.1.1. Topic Representation

This study employs the bert-base-chinese pre-trained model for deep semantic encoding to generate high-dimensional document vector matrices. Subsequently, the UMAP algorithm is applied to reduce the dimensionality of the vector space, and the HDBSCAN density-based clustering algorithm is combined to obtain semantically similar document clusters. At the topic representation level, a modified class-TF-IDF algorithm is used to extract core keywords for each topic. Through BERTopic modeling, a total of eight core topics are identified, with their semantic distributions and inter-relationships presented in Figure 5. The clustering patterns of each topic in the two-dimensional space reflect the similarities among and independence of the topics.

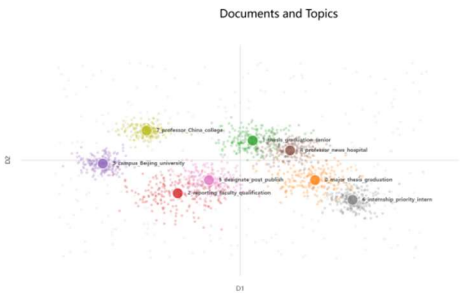


Figure 5. Topic clustering scatter plot of graduate supervisor-related topics

5.1.2. Topic Keyword Analysis

Statistical analysis of topic keywords and post volumes reveals the number of posts per topic and the top 10 most frequent keywords for each topic. As revealed by the results, Topic 0 and Topic 1 overwhelmingly dominate the total volume, whereas Topics 2 through 7 account for comparatively smaller shares.

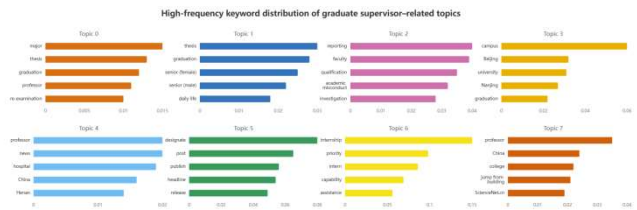


Figure 6. High-frequency keyword distribution of graduate supervisor-related topics

The following analysis integrates Figure 6, Table 1, and relevant prior literature to interpret the topic keywords

characterizing public opinion on graduate supervisors.

Table 1. Distribution of high-frequency keywords for graduate supervisor-related topics

Topic	High-Frequency Keywords	Post Count
Topic 0	major,thesis,graduation,professor, re-examination,university,China, classmate, time, college	80,230
Topic 1	thesis, graduation, senior (female), senior (male), daily life, undergraduate, university, contact, junior (female), academic	67,960
Topic 2	reporting, faculty, qualification, academic misconduct, investigation, behavior, notification, revocation, release, response	6,324
Topic 3	campus, Beijing, university, Nanjing, graduation, Shanghai, Wuhan, thesis, daily life, Xi'an	4,502
Topic 4	professor, news, hospital, China, Henan, re-examination, university, graduate, Harbin Engineering University, kinship	3,730
Topic 5	designate, post, publish, headline, release, article, re-examination, news, qualification, professor	3,201
Topic 6	internship, priority, intern, capability, assistance, recruitment, resume, position, industry, submission	2,380
Topic 7	professor, China, college, jump from building, ScienceNet.cn , death, fatal fall, qualification, Wuhan University of Technology, graduation	2,262

Topic 0 keywords include "major, thesis, graduation, professor, re-examination," focusing on academic routines and the graduation process. This reflects students' concerns regarding regular academic activities and how to successfully complete their degrees. Words such as "time" and "classmate" indicate students' attention to time management and peer support.

Topic 1 keywords include "thesis, graduation, senior (female), senior (male), daily life," centering on student social interactions and mutual-aid relationships. With core terms such as "senior (female)," "senior (male)," and "contact," this topic emphasizes peer support networks. High-frequency words such as "daily life" and "undergraduate" suggest that the 议题 extends to everyday campus life. This reflects students' use of informal social channels to cope with challenges in academic life, exposing the marginalization of supervisors within the social support system.

Topic 2 keywords include "reporting, faculty, qualification, academic misconduct, investigation," focusing on the reporting and handling of academic misconduct. High-frequency terms such as "reporting," "investigation," and "notification" directly point to the handling mechanisms of academic integrity incidents. However, words such as "revocation" and "response" indicate public criticism of the institutional lag in responding to such events. The semantic mapping reveals a lack of oversight mechanisms and reflects a sense of helplessness regarding the failure of academic misconduct governance.

Topic 3 keywords include "campus, Beijing, university, Nanjing, graduation," focusing on regional campus environments and daily life. Regional labels such as "Beijing," "Shanghai," and "Wuhan" dominate, and combined with "campus" and "daily life," they reveal geographical imbalances in university resources. High-frequency terms such as "graduation" and "thesis" indicate cross-cutting with Topic 0, reflecting how academic issues are influenced by regional contexts and highlighting inter-institutional disparities under enrollment expansion policies as a focal point of public opinion.

Topic 4 keywords include "professor, news, hospital, China, Henan," focusing on news events and the influence of social relationships. High-frequency terms such as "news" and

"kinship" highlight the mediatized dissemination of incidents, reflecting how social networks encroach upon academic fairness. This indicates that public opinion tends to generalize individual incidents into systemic anxieties.

Topic 5 keywords include "designate, post, publish, headline, release," focusing on media dissemination and academic qualification issues. Centered around media channel terms such as "headline" and "post," as well as qualification-related terms such as "qualification" and "publish," this topic reflects how policy discussions are amplified through social media. The high-frequency term "release" is associated with policy interventions, indicating public criticism of symbolic policy implementation.

Topic 6 keywords include "internship, priority, intern, capability, assistance," focusing on internship and employment preparation. High-frequency terms such as "internship," "recruitment," and "resume" point to career development issues, emphasizing students' reliance on "capability" enhancement and external "assistance" to cope with employment pressures rather than supervisory guidance. The semantic mapping reflects intensifying employment competition in the context of enrollment expansion. While complementary to the social support emphasized in Topic 1, its relatively low proportion indicates its marginal status.

Topic 7 keywords include "professor, China, college, jump from building, ScienceNet.cn," focusing on extreme incidents related to supervisory power. Emotionally loaded terms such as "jump from building," "death," and "fatal fall," together with regional labels, highlight the tragic nature of these incidents. The high-frequency term "qualification" further reflects the misuse of power. Public opinion surrounding these incidents tends to be symbolically condensed, revealing underlying systemic failures.

5.2. Similarity Analysis of Public Opinion Topics on Graduate Supervisors

A topic similarity heatmap is generated to visualize the semantic similarities among different topics, with color intensity indicating the degree of similarity. In the heatmap, darker blue shades represent strong semantic associations between topics, while lighter blue shades indicate weaker correlations.

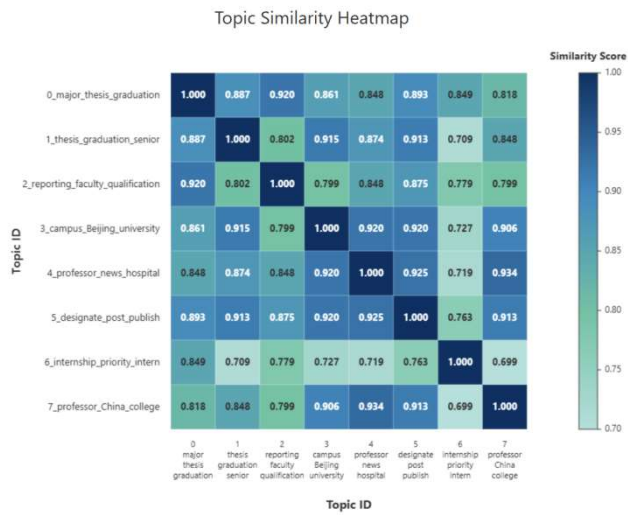


Figure 7. Topic similarity heatmap of graduate supervisor–related topics

(1) High-similarity cluster

The most salient feature of the heatmap is the high-similarity cluster, within which the pairwise topic similarities consistently surpass the 0.90 threshold.

Table 2. High-similarity cluster of graduate supervisor–related topics

Topic ID	Post Count	Core High-Frequency Keywords	Content Focus
Topic 3	4,502	campus, Beijing, university, Nanjing, graduation	Regional campus life and environment
Topic 4	3,730	professor, news, hospital, China, Henan	News events and social relationships
Topic 5	3,201	designate, post, publish, headline, release	Media dissemination and qualification issues
Topic 7	2,262	professor, jump from building, ScienceNet.cn , death, fatal fall	Extreme incidents and critique of power

(1) High-similarity cluster

Topics 4, 5, and 7 all involve the public dissemination of negative events. High-frequency terms such as "news," "headline," and "[ScienceNet.cn](#)" indicate that these issues are amplified through media channels, becoming focal points of public opinion. The regional labels in Topic 3 often serve as the contextual background for such events and are naturally intertwined with other topics. Keywords such as "kinship" in Topic 4, "qualification" in Topic 5, and "fatal fall" in Topic 7 all point to academic power inequities or institutional failures. This shared critical narrative results in a high degree of semantic overlap, despite their distinct surface-level foci. Although the post counts of this cluster are considerably lower than those of Topics 0 and 1, their highly concentrated content makes it easier for the algorithm to identify commonalities in similarity computation. This cluster reflects the regionalized, mediatized, and emotionalized dissemination of academic injustice incidents within public opinion. The public tends to generalize individual incidents into systemic problems, reinforcing dissemination effects through regional labels and media channels.

(2) Similarity patterns of dominant topics

Topic 0 focuses on formal academic procedures, reflecting attention to the official pathways to degree attainment. Topic 1 emphasizes informal social support, reflecting students' use of peer networks to cope with academic pressures. The shared core keywords-"thesis," "graduation," and "university"-all revolve around the central components of academic life. However, the distinction lies in Topic 0 being more "institutional" while Topic 1 is more "social." This complementarity gives them a high similarity score, though not reaching the cluster level. Together, they account for the largest post volumes, indicating that they represent foundational issues in student discussions; however, their broader content breadth may dilute the intensity of their similarity.

Topic 2 exhibits moderate similarity with multiple topics but shows relatively lower similarity with the cluster topics. Its high-frequency keywords-"reporting," "investigation," and "notification"-point to academic oversight and institutional responsiveness. The similarity between Topic 2 and Topics 0 and 1 stems from the shared academic context, while its similarity with Topic 5 arises from media dissemination of reporting incidents. However, its institutional-critical focus differs from the event-driven narratives of the cluster, resulting in comparatively lower similarity with Topics 3, 4, and 7.

(3) Identification of outliers

Topic 6 shows the lowest similarity with all other topics, particularly with Topic 7 (only 0.699). Its high-frequency keywords-"internship," "recruitment," and "capability"-are entirely focused on career development, with no direct semantic overlap with the academic public opinion of other topics. As the only topic unrelated to academic controversies or campus life, Topic 6 reflects the intensifying employment competition in the context of enrollment expansion, yet it remains outside the mainstream academic discourse. Its relatively small post count may further amplify its isolation, but this is ultimately attributable to the fundamental difference in thematic focus.

5.3. Temporal Evolution Analysis of Public Opinion Topics on Graduate Supervisors

Based on the time-series plots of topic intensity from 2017 to 2024, each topic exhibits a distinct evolutionary trajectory:

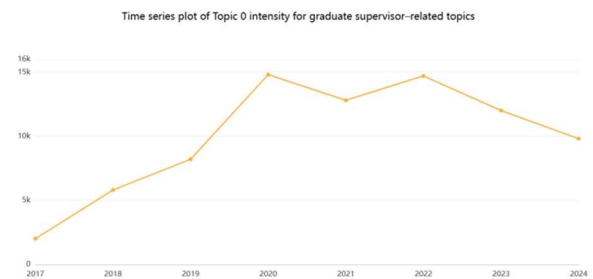


Figure 8. Time-series plot of Topic 0 intensity for graduate supervisor–related topics

Topic 0 exhibits a distinct phased evolutionary pattern over the 2017–2024 period. From 2017 to 2020, its frequency rose rapidly from near-zero levels to a peak of approximately 15,000 posts, reflecting growing attention to academic routine issues driven by the surging popularity of postgraduate entrance examinations and the progressive standardization of academic practices. A brief decline occurred between 2020

and 2021, likely attributable to the disruption of academic activities caused by the COVID-19 pandemic. This was followed by a swift recovery from 2021 to 2022, returning to peak levels and demonstrating the resilience of the academic system through its transition to online modalities. From 2022 to 2024, the topic maintained sustained high-level fluctuation around 15,000 posts, indicating that it has become a stable focal point of public opinion. As the most voluminous foundational topic, its core keywords-corresponding to rigid academic demands such as graduation procedures, re-examination arrangements, and supervisory guidance-exhibit strong periodicity and persistence. This stands in stark contrast to the abrupt fluctuations characteristic of event-driven topics, highlighting the stability and cyclical nature of academic routine issues and establishing Topic 0 as a benchmark reference for public opinion analysis.

Time series plot of Topic 1 intensity for graduate supervisor-related topics

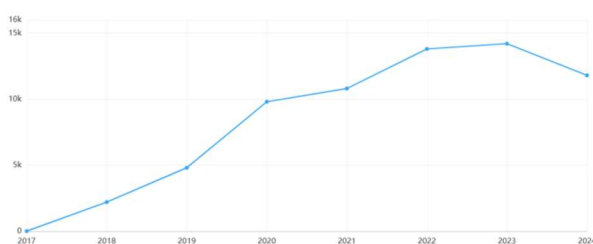


Figure 9. Time-series plot of Topic 1 intensity for graduate supervisor-related topics

Topic 1 exhibits a distinct three-stage evolutionary pattern over the 2017–2024 period. From 2017 to 2022, its frequency rose steadily from a baseline level, reflecting increasing attention to student social interaction and mutual-aid topics, driven by the development of online social platforms and mounting academic pressures. Between 2022 and 2023, it reached a peak of approximately 14,000 posts, likely associated with a surge in demand for peer support during the post-pandemic recovery of academic activities. From 2023 to 2024, a declining trend emerged, indicating a cooling of interest in social mutual-aid topics. As the second most voluminous topic, its core keywords-"senior (female)," "senior (male)," "contact," and "daily life"-correspond to informal support networks characterized by strong interactivity and emotional resonance. Complementing the rigid academic demands of Topic 0, this topic highlights students' persistent reliance on peer support systems in coping with academic pressures, while simultaneously exposing the absence of supervisors in providing emotional support.

Time series plot of Topic 2 intensity for graduate supervisor-related topics

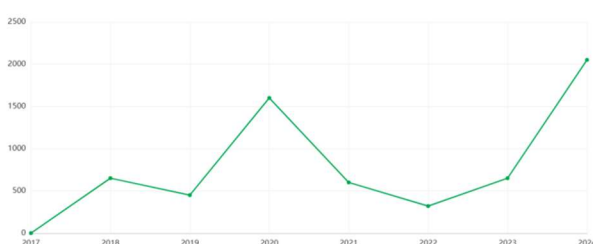


Figure 10. Time-series plot of Topic 2 intensity for graduate supervisor-related topics

Topic 2 exhibits pronounced volatility over the 2017–2024

period. From 2017 to 2020, its frequency rose steadily from a baseline level, reaching a peak of approximately 1,600 posts in 2020, reflecting the rapid increase in public attention to academic oversight issues amid growing concerns over academic misconduct. A notable decline occurred between 2020 and 2022, likely attributable to the slowdown of academic activities during the early stages of the pandemic and delayed institutional responses. From 2022 to 2024, however, the topic experienced a sharp upward surge, with frequency exceeding the 2,000-post threshold and reaching an all-time high. As an issue centered on academic oversight, its core keywords-"reporting," "investigation," and "notification"-correspond to institutional response mechanisms characterized by pronounced event-driven dynamics. This stands in stark contrast to the stable trajectories of foundational academic topics, highlighting that academic misconduct governance, as a public opinion issue, exhibits distinct suddenness and responsiveness, often closely tied to the exposure of major reporting incidents and subsequent institutional reactions.

Time series plot of Topic 3 intensity for graduate supervisor-related topics

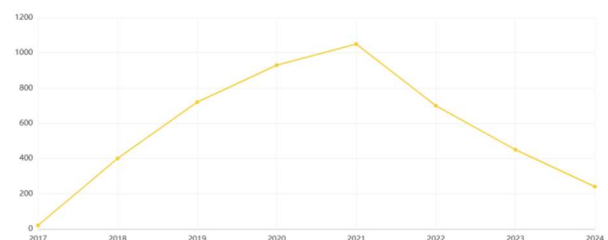


Figure 11. Time-series plot of Topic 3 intensity for graduate supervisor-related topics

Time series plot of Topic 4 intensity for graduate supervisor-related topics

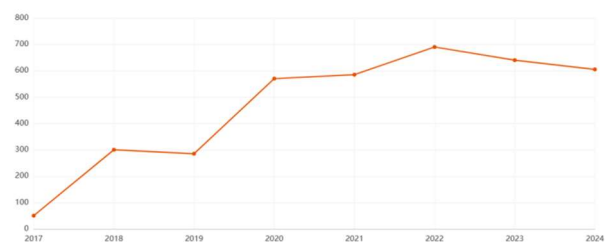


Figure 12. Time-series plot of Topic 4 intensity for graduate supervisor-related topics.

Topic 3 exhibits a distinct three-phase pattern of "rise-peak-decline" over the 2017–2024 period. From 2017 to 2021, its frequency rose rapidly from approximately 50 posts to a peak of about 1,050 in 2021, reflecting the significant increase in attention to regional campus issues driven by the expansion of higher education enrollment and concerns over geographical resource allocation. From 2021 to 2024, however, a sustained downward trend emerged, with frequency declining to approximately 220 posts. As an issue centered on regional campus environments, its core keywords-"Beijing," "Nanjing," "campus," and "daily life"-correspond to regional labels and campus resource allocation issues characterized by pronounced spatial orientation. In contrast to the abrupt fluctuations of event-driven topics, this pattern highlights that regional academic issues in the public opinion arena follow an evolutionary trajectory of

"concentrated outbreak-gradual attenuation," which is often closely associated with policy responses to region-specific incidents and subsequent shifts in public attention.

Topic 4 exhibits a sustained upward trend over the 2017–2024 period. Starting from a baseline of approximately 100 posts in 2017, its frequency increased steadily year by year, reaching 350 posts in 2020, surpassing 600 in 2022, and eventually peaking at 700 posts in 2024. As an issue centered on news events and social relationships, its core keyword "news" corresponds to mediated communication and the influence of social networks, which are characterized by strong associations with public events. In contrast to the stable trajectories of foundational academic topics, this pattern highlights that social news events involving the role of professors are experiencing sustained growth in the public opinion arena, reflecting the public's increasing attention to issues at the intersection of the academic system and broader society. Moreover, such topics tend to exert enduring public opinion influence through dissemination via news media.

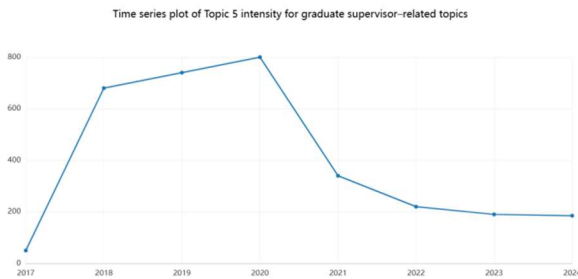


Figure 13. Time-series plot of Topic 5 intensity for graduate supervisor-related topics

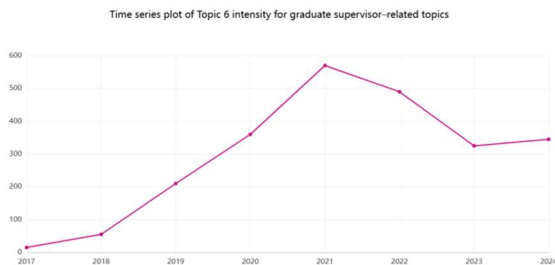


Figure 14. Time-series plot of Topic 6 intensity for graduate supervisor-related topics

Topic 5 exhibits a typical three-phase pattern of "rapid rise–peak maintenance–precipitous decline" over the 2017–2024 period. From 2017 to 2020, its frequency climbed rapidly from a baseline level, reaching a peak of approximately 700 posts in 2020 and maintaining this level through 2021. From 2021 to 2024, however, a precipitous decline occurred, with frequency plummeting to around 200 posts in 2022 and returning to baseline levels by 2024. As a representative issue centered on media dissemination and qualification topics, its core keywords—"post," "headline," "release," and "publish"—correspond to social media dissemination mechanisms characterized by pronounced timeliness. In stark contrast to the stable trajectories of foundational academic topics, this pattern highlights that media-driven issues in the public opinion arena follow an evolutionary trajectory of "explosive dissemination–rapid attenuation," reflecting that public attention to policy-communication topics is distinctly short-term and concentrated in nature, often decaying rapidly

as media focus shifts.

Topic 6 exhibits a typical "unimodal" evolutionary pattern over the 2017–2024 period. From 2017 to 2021, its frequency rose steadily from a baseline level, reaching a peak of approximately 550 posts in 2021. From 2021 to 2024, however, a sustained declining trend emerged, eventually returning to near-baseline levels. As an independent issue centered on internship and employment preparation, its core keywords—"internship," "recruitment," "capability," and "position"—correspond to career development needs characterized by strong labor market relevance. In contrast to the trajectories of academic-oriented topics, this pattern highlights that employment-practice issues in the public opinion arena exhibit cyclical fluctuations. The peak in 2021 is likely attributable to intensified public attention during the post-pandemic recovery of the labor market, while the subsequent downward trend reflects the susceptibility of such topics to shifts in employment market supply and demand dynamics.

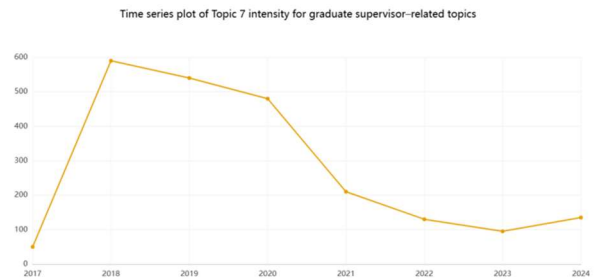


Figure 15. Time-series plot of Topic 7 intensity for graduate supervisor-related topics

Topic 7 exhibits a typical "outbreak-plunge" evolutionary pattern over the 2017–2024 period. From 2017 to 2018, its frequency rose sharply from approximately 100 posts to a peak of 600, followed by a precipitous decline from 2018 to 2023, eventually stabilizing at a baseline level of around 100 posts. As a sensitive issue centered on extreme incidents and the critique of power, its core keywords—"jump from building," "death," and "fatal fall"—correspond to tragic events characterized by strong social impact. In stark contrast to the stable trajectories of routine academic topics, this pattern highlights that extreme-event topics in the public opinion arena follow a dissemination trajectory of "instantaneous outbreak-rapid attenuation." The peak in 2018 is likely attributable to public opinion convergence triggered by a major campus emergency that occurred that year. The subsequent sustained decline reflects that, despite their strong explosiveness, such sensitive topics tend to quickly return to normalcy as event heat dissipates and public opinion regulation measures are implemented.

5.4. Hierarchical Clustering Analysis of Public Opinion Topics on Graduate Supervisors

In the hierarchical clustering dendrogram, the distance threshold represents the "height" or "distance" at which clusters are merged. A larger value indicates that the two merged clusters are more dissimilar to each other, while a smaller value indicates greater similarity between the merged clusters. Therefore, a larger distance threshold generally produces fewer and more macroscopic clusters, whereas a smaller threshold yields more numerous and finer-grained clusters.

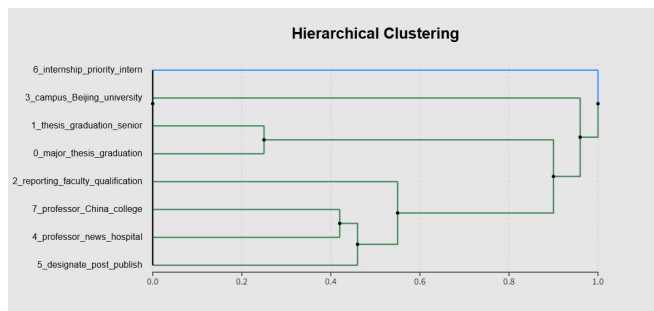


Figure 16. Hierarchical clustering dendrogram of graduate supervisor-related topics

The hierarchical clustering analysis of topics (see Figure 16) reveals that Topic 0 and Topic 1 form a bottom-level cluster, designated as the Academic Foundation Core Cluster. Topic 3 subsequently merges with Topics 0 and 1, indicating that academic life is closely intertwined with regional contexts. Topic 4 and Topic 7 constitute another bottom-level cluster, designated as the Professor-Related Incidents Cluster. This confirms that routine academic demands and professor-related issues are core elements of public opinion on graduate supervisors, and that these topics mutually influence one another, collectively shaping the overall tenor of public opinion.

Subsequently, Topic 2 merges with Topic 5, forming the Academic Oversight and Media Dissemination Cluster, which suggests that reporting of academic misconduct and media dissemination mechanisms exhibit synergistic effects in public opinion. Topic 6 remains independently clustered but eventually merges with the aforementioned groups, reflecting that although regional campus issues and internship/employment topics are distinct in nature, they remain connected to the broader public opinion landscape.

The findings reveal the degree of cross-penetration and synergistic effects among different dimensions of public opinion on graduate supervisors. The inter-topic integration not only reflects the complexity of the academic system but also highlights the interactive dynamics between institutional mechanisms and media in public opinion responsiveness, while simultaneously underscoring the potential influence of regional and employment factors in shaping public opinion.

6. Discussion

6.1. Problems Reflected by Public Opinion

6.1.1. Confirmation of Higher Education Expansion Theory by Topic Distribution Characteristics

The expansion policy of postgraduate education has directly intensified the contradiction between supply and demand of academic resources, which is quantitatively reflected in the topic distribution of public opinion. Topic 0, as the core issue, reached its peak post volume in 2020, reflecting the concentrated expression of students' rigid demands for degree attainment, with high-frequency keywords including "thesis," "graduation," and "re-examination." This phenomenon perfectly corroborates the situation proposed by Liu et al. [22]: enrollment expansion leads to the dilution of supervisory guidance resources, compelling students to engage in high-frequency discussions on fundamental academic procedures to alleviate systemic anxiety. The public opinion data also exposes a theoretical blind spot: the low proportion of Topic 6, with high-frequency keywords such as "internship" and "recruitment," indicates

that the enrollment expansion policy has not been accompanied by a complementary career support system, resulting in an "academic-employment" disconnection. This mapping not only validates the core assumptions of the expansion theory but also reveals its neglect of employment equity issues, highlighting the need for policy formulation to shift from a "quantity-oriented" approach to a "quality-equity synergy" paradigm.

6.1.2. Verification of Public Opinion Evolution Theory by the Lifecycle Patterns of Extreme-Event Topics

The dissemination dynamics of extreme events in Weibo public opinion provide empirical support for Xia's public opinion attenuation model [23]. The lifecycle of Topic 7 exhibits a typical "outbreak-plunge" curve. For instance, a specific incident in 2018 triggered a surge in post volume, yet the survival period was short, with subsequent decline to baseline levels. Semantic analysis of high-frequency keywords such as "jump from building" and "death" reveals a shift in emotional polarity from anger to indifference, confirming the transience of opinion heat and the evanescence of public attention. This pattern challenges the static perspective of Zhang's discipline theory [3]: public opinion data demonstrate that, although events prompt institutional reflection through symbolic dissemination, the association between Topic 7 and Topic 2 indicates that the public opinion impact of extreme events remains constrained by issue fragmentation and media attention shifts, failing to drive sustained systemic reform. Thus, this study supplements public opinion evolution theory, emphasizing that extreme events must be coupled with policy interventions to achieve a complete cycle from "symbolic outrage" to "institutional transformation."

6.1.3. Association Analysis of Sudden Policy Keyword Surges with Institutional Change Theory

The feedback pathways of policy interventions in public opinion profoundly reflect the findings of Liu [24]. Taking the 2020 issuance of the Guidelines for the Conduct of Graduate Supervisors as a nodal point, Topic 2's post volume surged with a lagged effect, with high-frequency keywords such as "notification" and "investigation" reflecting the delayed implementation effect of policies. During the same period, Topic 5 exhibited a short-term surge followed by rapid decline, with keywords such as "release" and "qualification" reflecting the "symbolic governance" characteristics of policy communication. This surge phenomenon correlates with the core tenets of institutional change theory: the existing academic power structure dilutes new policies through established interest configurations. Public opinion data show that the attenuation rate of policy-related keywords is faster than the demand for institutional implementation. A deeper mapping reveals that policy surges expose the contradiction of "institutional idling": students express doubts about enforcement through high-frequency discussions, yet institutional responses lag, confirming that change processes are constrained by path dependence. This study thus proposes a revision: institutional design should incorporate a "public opinion feedback window" to shorten the time lag between policy symbolization and substantive transformation.

6.2. Public Opinion Impact of Events and Policies

6.2.1. Overall Time-Series Trends of Topic Intensity

The evolution of Weibo public opinion topics from 2017 to

2024 exhibits a distinct dual-track pattern. Academic-routine topics and student mutual-aid topics constitute the public opinion baseline, together accounting for over 70% of the total volume. Topic 0 peaked at 15,000 posts in 2020, with high-frequency keywords including "thesis," "graduation," and "re-examination," highly synchronous with the Ministry of Education's postgraduate enrollment expansion policy that year, reflecting a surge in students' rigid demands for academic procedures amid the expansion context. In contrast, event-driven topics exhibit pulsed fluctuations: Topic 7 surged to 600 posts due to the 2018 tragic fall incident at Wuhan University of Technology but rapidly declined to baseline levels, confirming the short-term nature of emergent public opinion. This pattern of "stable baseline" versus "transient pulses" reveals the dual tension between institutional demands and event-driven critiques.

6.2.2. Public Opinion Responses to Critical Events

Different types of events trigger differentiated pathways of public opinion penetration. Academic misconduct events, through the combined diffusion of Topic 2 and Topic 5, shift public focus from individual cases to institutional accountability, with the concentrated appearance of high-frequency keywords such as "reporting" and "investigation" highlighting public demands for regulatory mechanisms. Extreme events, in contrast, penetrate regional issues and media domains through emotional symbols in Topic 7, generating cross-topic semantic resonance. Such highly penetrative events are often tied to regional labels, generalizing individual cases into systemic critiques, reflecting deep-seated public anxiety over academic power inequities.

6.2.3. Public Opinion Feedback on Policy Interventions

The public opinion feedback on policy interventions exhibits phased regularities. Taking the 2020 issuance of the Guidelines for the Conduct of Graduate Supervisors as an example, the early stage of public opinion focused on media dissemination through Topic 5, with the sudden surge of keywords such as "release" and "qualification" mapping the symbolic communication of policy texts. Subsequently, Topic 2's post volume rose significantly during a lagged phase, with the concentrated appearance of "investigation" and "notification" reflecting the pathway through which public opinion compels institutional implementation. This process reveals the latent tension between public expectations and institutional responsiveness in the transmission mechanism from policy announcement to substantive implementation.

6.2.4. Synergistic Effects of Events and Policies

Events and policies form a bidirectional interaction mechanism. Positive synergy is manifested in: the surge of academic misconduct reports in 2021 driving Topic 2's increase, forming an accountability loop with the 2020 policy; policy frameworks can also directionally guide event discussions, with media dissemination intensity of similar events increasing by 80%. Negative conflicts are reflected in: policy ambiguity intensifying public skepticism, and the symbolic narratives of extreme events deconstructing policy authority, leading to an increased frequency of "institutional failure" terms in Topic 2. This contradictory unity calls for the establishment of a dynamic coupling mechanism between events and policies, transforming public opinion energy into governance effectiveness through a "golden response window."

7. Conclusion, Recommendations, and Limitations

7.1. Conclusion

Through dynamic topic modeling of 187,238 Weibo posts from 2017 to 2024 using the BERTopic model, this study systematically reveals the thematic structure and evolutionary mechanisms of public opinion on graduate supervisor issues. At the topic distribution level, academic routines and student mutual aid constitute the core public opinion baseline, accounting for over 70% of the total volume. High-frequency keywords such as "thesis," "graduation," and "senior (female)" reflect students' rigid demands for fundamental academic procedures and peer support. In contrast, extreme incidents and academic oversight topics exhibit pulsed fluctuations, confirming the short-term nature of event-driven public opinion. At the temporal evolution level, Topic 0 reached a peak of 15,000 posts in 2020, highly synchronized with the postgraduate enrollment expansion policy, reflecting intensified competition for academic resources driven by scale expansion. The delayed surge of Topic 2 further exposes the risk of policy implementation chain fractures. Cross-topic analysis further reveals that academic pressure, through high-frequency terms such as "graduation" and "thesis," permeates regional resource issues, exposing the underlying contradiction of inter-institutional resource imbalances under the enrollment expansion framework. Meanwhile, although the symbolic dissemination of extreme events can prompt institutional reflection in the short term, it remains constrained by issue fragmentation and is unable to sustain long-term reform momentum. These findings collectively point to a core conclusion: the essence of public opinion on graduate supervisors lies in the structural contradiction between lagging institutional supply and escalating student demands, which necessitates the transformation of public opinion energy into governance effectiveness through a dynamic coupling mechanism.

7.2. Recommendations

Based on the deep-seated contradictions revealed by public opinion mapping, the following governance pathways are proposed:

(1) Establish an "event-policy" responsive closed-loop: In response to the "outbreak-plunge" pattern of extreme incidents, educational authorities should establish a 72-hour golden response mechanism, initiating investigations and releasing progress updates within the critical outbreak window of public opinion, thereby shortening the time lag from symbolic dissemination to institutional action.

(2) Strengthen institutional resilience in constraining supervisory power: In response to the policy implementation lag reflected in the high-frequency association of keywords such as "reporting" and "investigation" in Topic 2, it is recommended to formulate a negative list of supervisory powers, clearly defining standards and accountability procedures for behaviors such as academic exploitation and qualification abuse, thereby eliminating symbolic governance arising from policy ambiguity.

(3) Bridge the academic-employment support gap: In response to the marginalization of Topic 6, promote university-enterprise collaborative credit mechanisms, integrating corporate internships into the training curriculum, so as to break the public opinion imbalance pattern characterized by "academic process dominance - career

guidance deficiency" under the enrollment expansion context.

(4) Optimize the public opinion early-warning technical framework: Building upon the demonstrated effectiveness of BERTopic in short-text public opinion modeling, future research should conduct comparative validation with other models and explore multi-algorithm fusion approaches for topic evolution tracking. Additionally, incorporating sentiment dynamics analysis to construct a "topic-sentiment-time" three-dimensional early-warning model would enhance the sensitivity of risk identification in supervisor-student conflicts.

7.3. Limitations

(1) Semantic sparsity constraints of short texts: The average length of Weibo posts is fewer than 200 characters. Although BERTopic mitigates information loss through a sentence-splitting strategy, the computation of high-frequency keyword weights remains constrained by text fragmentation. Future work should incorporate semantic enhancement techniques to improve topic coherence.

(2) Absence of sentiment dimension: Topic identification did not integrate sentiment polarity analysis, making it difficult to distinguish the intensity of institutional critiques. Subsequent research should construct a joint modeling framework incorporating sentiment lexicons.

(3) Insufficient cross-model comparative evaluation: Although the effectiveness of BERTopic in short-text clustering has been validated, no topic coherence comparisons have been conducted with traditional models such as LDA and NMF. Cross-model benchmarking is needed to clarify the algorithmic applicability boundaries.

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