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Research on the Evolution and Simulation of Online Public Opinion on Emergencies in Universities in the New Era

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Abstract: This paper uses the data crawling and screening of university emergencies that occurred from January 2021 to December 2024, and uses them as research samples to classify and summarize in detail, and summarizes and summarizes the categories and basic characteristics of university public opinion. By constructing a dynamic simulation model, this paper deeply analyzes the evolution process of online public opinion on emergencies in colleges and universities and explores the changing trend and key factors of public opinion at different stages. The results show that the evolution of online public opinion on emergencies in colleges and universities is complex and dynamic, and is affected by a variety of factors. On this basis, this paper proposes a targeted public opinion response strategy, aiming to provide a scientific basis for university management departments to effectively prevent and respond to the occurrence and development of online public opinion in emergencies.

1. Introduction

In recent years, the frequent occurrence of emergencies in universities has had a huge negative impact on the stable development of schools and society. In this context, the phenomenon of online public opinion triggered by sudden incidents in universities has gradually become a new focus of attention and exploration for relevant scholars. Foreign research focuses on the theoretical expansion of communication mechanisms. Russell et al.[1] studied the differences in online public opinion views among college students in different public opinion environments. Kim et al.[2]explored the dynamic mechanism of the dissemination and decline of online public opinion in higher education institutions based on the life cycle theory. Maresh Fuehrer et al.[3]innovatively constructed a mathematical model of public opinion and revealed the non-singular reasons for the outbreak of online public opinion through analysis, namely the joint action of multiple trigger points leading to the outbreak of public opinion. Domestic scholars' research on sudden incidents in universities mainly focuses on four dimensions: theoretical research on online public opinion, research on the characteristics of online public opinion, research on the evolution stages and laws of online public opinion, and research on response strategies. Zhou Yuanyuan[4] conducted an in-depth analysis of the four main factors influencing online public opinion generation in universities, including social environment, media

environment, netizens' psychology, and the development of universities themselves. Based on this, summarize the new dissemination characteristics of online public opinion in universities in the new era. Xie Kefan et al.[5]divided the development process of public opinion into five stages based on the life cycle theory and the evolution law of public opinion: incubation period, germination period, acceleration period, maturity period, and decline period. Peng Jingjing[6]revealed that in the new era, online public opinion in universities exhibits significant randomness, rapid diffusion, and widespread influence. Especially after emergencies occur in universities, the lack of effective guidance measures can easily lead to the emergence of public opinion crises. Therefore, universities need to follow the principles of science and openness, respond to online public opinion promptly, integrate communication channels, and deepen their grasp of mainstream public opinion. Bian Jingmei et al.[7]constructed a four-party game model of netizens, online media, parties, and government, and used evolutionary game theory to analyze the dynamic evolution process and influencing factors of four-party strategy choices under different government response attitudes. At the same time, MATLAB software was used to simulate the evolution trend of public opinion under different conditions. This article aims to fill the current research gap by providing scientific public opinion management strategies for university administrators and relevant departments through systematic data analysis and simulation modeling.

2. Types and Characteristics of Online Public Opinion on Sudden Incidents in Universities

This study used web crawling technology to comprehensively collect information on sudden incidents that occurred in universities from January 2021 to December 2024. Based on the text content, with sudden events and negative online public opinion as key indicators, the data is subjected to secondary screening to eliminate rumors, duplicate information, and samples with low relevance to this study. After rigorous screening, 139 representative cases were ultimately selected as the research subjects. Through the in-depth combing and analysis of these cases, the emergencies in colleges and universities that have attracted widespread public attention in the past three years can be summarized into four categories: teacher style and morality, life contradictions, university management, and society as a whole, as shown in Table 1.

Table 1: Analysis of Network Public Opinion Types for Emergencies in Universities.

Event type	Primary coverage	Cause of the event	characteristic
Teacher's style and ethics	Academic fraud, sexual assault scandal, teacher-student relationship	Caused by academic fraud, sexual harassment, and "coercive" teacher-student relationships.	National participation, diverse channels; Rapid dissemination and interconnectedness; The personnel involved are simple and the contradictions are concentrated; The issues related to teacher ethics and style are prominent, and negative emotions are relatively strong in the early stages of public opinion.
Contradictions in daily life	Interpersonal conflicts, personal words and actions	It may be caused by conflicts between classmates, family reasons, romantic relationships, or other interpersonal conflicts, or it may be caused by teachers' or students' personal inappropriate remarks or behaviors.	
University Management	Administrative management, safety management	The improper, non-standard, and illegal management issues in universities have caused damage to the rights and interests of teachers and students, leading to serious dissatisfaction.	
Society as a whole category	Political economy, natural disasters, public health	Political, natural disasters, public health and other factors.	

3. Analysis of the Evolution of Online Public Opinion in Higher Education Emergencies

3.1. Public Opinion Participants

In the evolution process of online public opinion on sudden incidents in universities, the participants in public opinion play a crucial role. The main parties involved in sudden incidents in universities are the faculty and students. School netizens are divided into three categories: grassroots netizens, opinion leaders, and online writers. Most grassroots netizens usually assume the roles of information receivers and disseminators; Opinion leaders have attracted a large number of followers with their outstanding problem-solving and judgment abilities; Online writers play a crucial role in shaping and guiding public opinion. However, sudden incidents in universities are no longer limited to the campus and often trigger widespread attention and in-depth discussions from all sectors of society. This study regards the group of university teachers and students and off-campus netizens as a unified whole, and conducts research as the main body of ordinary netizens, rather than conducting special research on the behavior of university teachers and students separately.

3.2. Evolution Cycle of Public Opinion

Based on the comparative analysis of the trend of public opinion propagation of multiple university emergencies and combined with the life cycle theory, the evolution process of public opinion is divided into two types: single peak (as shown in Figure 1) and multiple peak (as shown in Figure 2), both of which include three stages: the latent diffusion period, the outbreak surge period and the heat subsidence period.The difference is that in a single peak public opinion evolution cycle, there is only one peak level, while in a multi peak public opinion evolution cycle, there will be two or even more peak levels, that is, after reaching the first peak of popularity, public opinion does not gradually fade, but experiences repeated fluctuations.

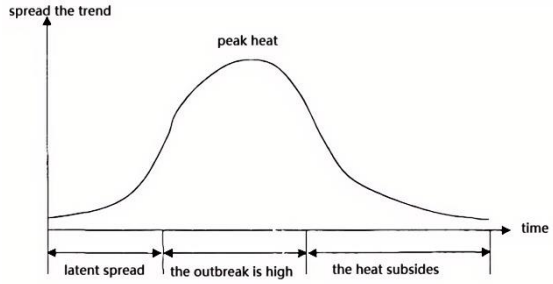

Figure 1: Trend of Single Peak Public Opinion Propagation Figure.

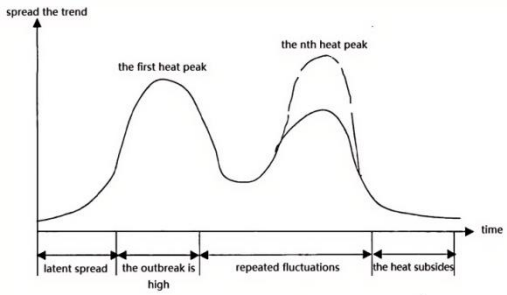

Figure 2: Trend of multi-peak public opinion Dissemination.

4. Modeling and Analysis of the Evolution of Network Public Opinion on Emergencies in Colleges and Universities

4.1. Model Assumptions

Based on the public opinion dissemination characteristics of sudden events in universities and the dynamic characteristics of network information dissemination, combined with the dynamic mean field differential equation, a model of the evolution stage of public opinion in universities is constructed. This study makes the following assumptions about the model:

(1) At the beginning of the study, the total number of network users was set to N, assuming that the number of users remained stable without significant changes. The total number of true, rumor

spreaders, and neutral immune individuals remains constant at N.

(2) Set the proportions of rumors, true information, and neutral or immune individuals in the network at time t to be $y(1)$, $y(2)$, $y(3)$, and the total sum to be 1. These ratios are differentiable functions of time t, reflecting dynamic changes $y(1)_{begin}$、$y(2)_{begin}$、$y(3)_{begin}$ Representing the proportion of each group at the initial moment.

(3) In the dissemination of online public opinion in universities, true information disseminators transmit information to neutral and rumor disseminators with probability p, while rumor disseminators transmit information to neutral and true information disseminators with probability q. Neutral individuals will not be affected by both at the same time.

(4) In the event of an emergency in universities, the number of derivative topics may be unpredictable. The public opinion triggered by the event may generate new derivative topics, and three types of communicators will create new topics as a result. When this information is published on public or personal platforms, followers can receive notifications.

4.2. Model Establishment

P: Prevalence of true information dissemination; q: Infection rate of rumor information dissemination; $Y(1)$: Rumor information disseminators, i.e. S; $Y(2)$: True information disseminators,i.e. K; $Y(3)$: Neutrals or immunizers, i.e. I; $y(1)$: Rumor information disseminators' share in the whole system, i.e. s; $y(2)$:True information disseminators' share in the whole system, i.e. K; $y(3)$:Neutrals or immunizers' share in the whole system, i.e. I.

$$\begin{aligned}\frac{\mathrm{dy}(3)}{\mathrm{dt}} &= -py(1)y(3) - q1y(2)y(3)\\ \frac{dy(1)}{dt} &= \mathrm{py}(1)\mathrm{y}(3) + (\mathrm{q}-\mathrm{p})\mathrm{y}(1)\mathrm{y}(2)\\ \frac{\mathrm{dy}(2)}{\mathrm{dt}} &= \mathrm{py}(2)\mathrm{y}(3) + (\mathrm{p}-\mathrm{q})\mathrm{y}(1)\mathrm{y}(2)\end{aligned} \tag{1}$$

Based on the characteristics of various stages of online public opinion in university emergencies, by setting the values of various parameters and incorporating them into the derived differential equations, numerical simulation calculations are carried out using MATLAB R2012b to draw corresponding ISKS simulation diagrams for each stage. The evolution process of online public opinion in university emergencies is simulated, and the impact of different parameters on public opinion dissemination is analyzed to provide a scientific basis for public opinion management strategies for university managers and relevant departments.

4.3. Analysis of the Evolution Model of Network Public Opinion in Various Stages of University Emergencies

In the latent diffusion stage of public opinion, given that the specific details are still unclear in the early stages of the event, most participants appear as neutral audiences. Set model parameters $y(3) = 0.94$, assuming that the proportion of rumor spreaders and true information spreaders is approximately equal and relatively small $p = q = 0.18$, $y(1)_{begin} = y(2)_{begin} = 0.03$ Set model parameters, assuming that the conversion rate of true information dissemination is approximately equal to that of rumor information dissemination. Set model parameters. If public opinion is not given

sufficient attention and handling in the early stages, the number of neutral or immune individuals will gradually decrease until only two types of netizens remain: true information disseminators and rumor disseminators, with their ratios approaching 0.5. At this point, the true information dissemination curve and the rumor information dissemination curve will coincide, but the probability of this situation occurring is almost zero, as shown in Figure 3.

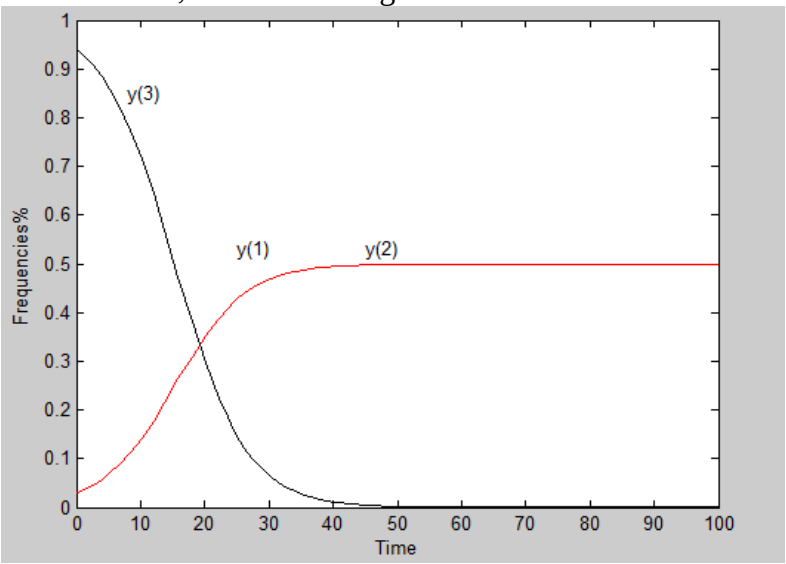

Figure 3: Simulation diagram of the latent diffusion period of network public opinion during sudden incidents in universities.

During the outbreak phase, the public speculated and discussed due to a lack of real information, leading to the spread of public opinion. The rumor spread rate q has significantly increased. When t=12, the proportion of true information disseminators reaches its peak and then decreases. At this point, the rumor spread rate q slowly increased to 0.36, and some people who spread true information turned into rumor spreaders. The true information spread rate p slightly decreased to 0.17. Rumor spreaders account for the highest proportion of Internet users, and many neutrals or immune people turn into rumor spreaders, as shown in Figure 4.

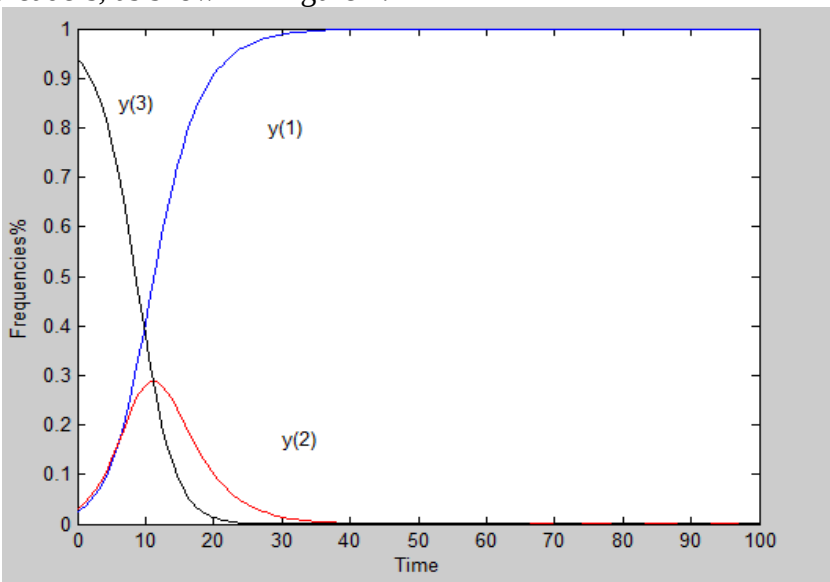

Figure 4: Simulation diagram of the peak period of network public opinion outbreak during sudden events in universities.

During the period of public opinion decline, the influx of real information has increased the conversion rate. This article points out that this influence and dissemination speed will exceed the rumor spread in the second stage, causing the p-value to increase to a maximum of 0.37, higher than the q-value. The q value drops to 0.15. At t=18, the ratio of rumor spreaders reaches its peak in a normal distribution and then decreases over time, while the ratio of true spreaders significantly increases and remains high,as shown in Figure 5.

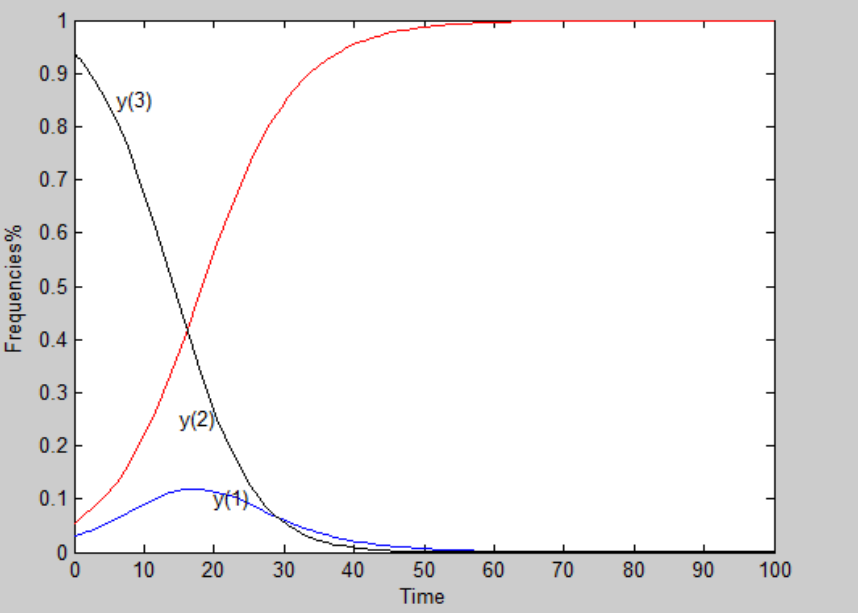

Figure 5: Simulation diagram of the subsidence period of online public opinion on emergencies in colleges and universities.

When studying the online public opinion of sudden incidents in universities, through evolutionary model simulation analysis, it was found that there are three main factors affecting information dissemination: the conversion rate of real information p, the conversion rate of rumor information q, and the time of real information release. The increase in the conversion rate q of rumor information will exacerbate the negative impact of neutral and true information disseminators, and increase the difficulty of public opinion control. The improvement of the conversion rate p of real information can accelerate the conversion of rumor spreaders, end rumors faster, and have a significant impact on the trend of public opinion. The early release of real information can enhance students' and netizens' tolerance and judgment towards rumors, indirectly controlling the trend of public opinion.

5. Strategies for Responding to Emergencies in Universities through Online Public Opinion

5.1. In the Latent Diffusion Stage of Public Opinion: Monitoring and Analysis

Universities and their management departments mainly rely on normalized monitoring mechanisms to respond to online public opinion during the latent diffusion stage of public opinion. These mechanisms include technical monitoring and manual management. Technical monitoring uses specialized tools to monitor the entire network platform, setting tracking conditions through sensitive words and location information to detect potential public opinion early; Manual management involves the management personnel and student backbone browsing and reviewing content to detect the source of public opinion early on and support intervention. At this stage, universities need to establish a rapid response mechanism. Once potential public opinion is detected, relevant departments and experts should be immediately organized to conduct analysis, evaluate the possible

direction and impact range of public opinion, reduce the spread and popularity of rumors, and improve the spread and popularity of real information. The analysis content should include the level of public opinion, the scope involved, the potential social impact, and the potential risk points. Through comprehensive analysis, develop targeted response strategies to ensure adequate preparation before the outbreak of public opinion.

5.2. In the Stage of Explosive Public Opinion: Guidance and Control

At the current stage, universities should utilize official channels and mainstream media to disseminate authentic information, actively respond to the concerns of netizens, and clarify misunderstandings. Through expert interpretation and online interaction, improve the interactivity and pertinence of information, and enhance netizens' acceptance of real information. Universities also need to strengthen the guidance and management of online public opinion, prevent the spread of rumors, and maintain the online public opinion environment. Universities cultivate professional public opinion management teams to closely monitor online public sentiment, promote authoritative and accurate information in a timely manner, and curb rumors. At the same time, encourage teachers and students to participate in positive guidance of online public opinion, enhance the power of real information dissemination, and increase their proportion in the online public opinion field. These measures will help universities cope with challenges steadily during the period of high public opinion and maintain campus harmony and stability.

5.3. In the Declining Stage of Public Opinion: Evaluation and Feedback

One is to enhance media literacy and the ability to resist external public opinion of college students and internet users. Through systematic cultivation, enhance their cognition and judgment, and effectively curb the spread of online public opinion. The second is to attach importance to the recovery and learning after the event. Universities should regularly hold lectures to cultivate students' correct understanding of the positive image of the school and release public welfare classes through official channels to enhance the public's positive impression of the university. Provide psychological counseling to alleviate the psychological impact when dealing with emergencies. The third is to conduct a post-event summary, which helps to understand the characteristics of new media public opinion and student perspectives, provide a scientific and standardized foundation for public opinion guidance, improve guidance mechanisms, and provide constructive suggestions for university policies. The fourth is to strengthen the training of teachers and staff on online public opinion knowledge, enhance their ability to respond to emergencies and identify and disseminate real information. The fifth is to establish a mechanism for tracing rumor information, hold the rumor mongers accountable in accordance with the law, publicize the results of the handling, warn potential rumor mongers, and purify the cyberspace. Encourage teachers, students, and all sectors of society to report rumors and create a good atmosphere for resisting rumors.

6. Conclusions

This paper deeply discusses the types, characteristics, and evolution process of online public opinion on university emergencies. It analyzes the various stages of public opinion evolution in detail by constructing a simulation model. The results show that the conversion rate of real information, the conversion rate of rumor information, and the release time of real information have a significant impact on the dissemination of public opinion. In the latent diffusion stage of public opinion, timely monitoring and judgment are the keys to reducing the impact of rumors and improving the efficiency of real information dissemination. In the upsurge stage, effective guidance and control through

official channels and mainstream media can significantly enhance netizens' acceptance of true information and curb the spread of rumors. In the declining stage of public opinion, establishing evaluation and feedback mechanisms plays an important role in improving the media literacy of college students and Internet users, enhancing the ability to resist external public opinion, improving the public opinion guidance mechanism, and purifying cyberspace. These research results provide scientific public opinion management strategies for university administrators and relevant departments, which will help them more effectively respond to online public opinion on emergencies in colleges and universities and maintain campus harmony and stability.

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