Original Research Article

Game behavior of negative public opinion in colleges and universities and its rectification and optimization

ABSTRACT

Aims: With the development of the Internet, more and more public opinion events in colleges and universities attract people's attention. Using the game theory method to analyze the public opinion events in colleges and universities, it can effectively improve the benefit of students and the degree of emphasis on the rectification of negative public opinion.
Methodology: The problem of negative public opinion in colleges and universities mainly involves four interest subjects: students, colleges and universities, and government supervision departments. Based on the thought of game theory, this paper studies the game behavior among government, students and universities under the condition of information asymmetry from the goal of university rectification and optimization
Conclusion: The analysis of the game Nash equilibrium found that improving the rectification cost of non-action in dealing with negative public opinion in colleges and universities and reducing the cost of supervision by government departments can effectively improve the benefit of students and the degree of emphasis on rectification in colleges and universities.

Keywords:Game; Nash equilibrium; Negative public opinion; Colleges and universities

1. INTRODUCTION

With the rapid development of information technology, the online platforms for college students to express their emotions and thoughts have gradually diversified.Online public opinion in colleges and universities refers to the opinions and opinions of college netizens that have strong influence and inclination around the occurrence and development of social situation and public opinion (usually some hot spots and focal issues in real life) in a specific cyberspace [1].The penetration of the Internet makes college netizens' views on college events more personal, and they are more inclined to evaluate college public opinion events through Internet media platforms. In recent years, there have been frequent negative public opinion incidents in colleges and universities, which have been fermented through the sharing of student netizens on social media platforms, thus forming an urgent public opinion direction and urgently requiring colleges and universities to respond positively.The public opinion of colleges and universities on the Internet reflects the overall image of colleges and universities, and also reflects the dynamic changes of students' thoughts. Therefore, it is of great significance to actively guide and deal with the negative public opinion in colleges and universities to establish a good image and grasp the leadership of network ideology.

By analyzing the stakeholders of negative public opinion in colleges and universities, when student netizens spread college events through network platforms, some colleges and universities still choose to do nothing about public opinion events and wait for the situation to calm down.Therefore, the joint efforts of government supervision departments and media can form a good ideological environment in colleges and universities.This paper analyzes the mixed strategy game model between student netizens and universities, as well as the mixed

strategy game model between government departments and universities under the management of government participation. This paper analyzes how to enhance the degree of attention of colleges and universities to deal with negative public opinion, and puts forward suggestions on how to reduce negative network public opinion communication and establish a positive image of colleges and universities.

2. LITERATURE REVIEW

There are many kinds of research methods on network public opinion, and many scholars have conducted researches on the evolution rules and control measures of network public opinion.For example, Ling et al. [2] adopted SOAR model to analyze the evolution path and trend of online public opinion in universities when the Internet user group is a negative emotion.Li et al. [3] put forward the stochastic resonance model of online public opinion in colleges and universities, and empirically analyzed how colleges and universities deal with and prevent the phenomenon of online resonance in colleges and universities.Chen et al. [4] studied the evolution process of the three-party game model and applied the model to the evolution of public opinion in network media.Long et al. [5] analyzed the dissemination characteristics and paths of negative online public opinions in universities through text mining, and put forward guidance suggestions.

In traditional online public opinion events, the game behavior of two or three parties among social media, netizens, opinion leaders or regulators is generally considered.Wen [6] constructed an evolutionary game model of online public opinion in colleges and universities under the four-party game of media, college students, universities and government, and discussed the influence of the behavioral strategies of four-party game players on the development of online public opinion in colleges and universities. Shen [7] constructed an evolutionary game model of negative online public opinion in universities based on SD to study the governance of negative online public opinion in university emergencies.

This paper establishes a mixed strategy game model between student netizens and universities, as well as a mixed strategy game model between government departments and universities under the management of government participation, and analyzes the behavior of negative public opinion stakeholders in universities.

3.MIXED GAME OF NEGATIVE PUBLIC OPINION IN UNIVERSITIES

3.1 THE MIXED GAME BEHAVIOR OF STUDENT NETIZENS AND UNIVERSITIES

3.1.1 Hypothesis and symbol description

The two sides of the game are student netizens and universities. It is assumed that all players are rational people, and all guide their behavior with the goal of maximizing their own interests. For student netizens, negative public opinions in colleges and universities are closely related to themselves. When public opinions occur, if they are disseminated, they will receive a positive effect, while if they are not disseminated, they will have no impact. For colleges and universities, dealing with network public opinion has a certain processing cost, so some colleges and universities choose to do nothing.The strategy set of student netizens is (spread, do not spread). The university's strategy set is to deal with public opinion (positive, negative).

Suppose that the income of student netizens' communication is a. If universities actively deal with public opinion events, the income of students isa_1; if universities do not actively deal with public opinion events, the income of students is a_2, $a_1 > a_2$.Suppose that the income of student netizens who do not spread is b; if universities actively deal with public opinion events, the income of students is b; if universities do not actively deal with public opinion events, the income of students is $-b$, where $b > a_1 > a_2$.This is due to the costs incurred by

student netizens when they carry out public opinion dissemination, such as time and emotional costs. Since the network information is complex and updated quickly, and the duration of public opinion is short, this paper assumes that no matter whether colleges and universities actively respond to public opinion events, there will be a constant profit R in the end. Colleges and universities have certain costs to deal with public opinion events, the cost of active response isc_1, the cost of negative response is c_2, in which $c_1 > c_2$.If universities deal negatively with public opinion events and student netizens use social media to spread them accordingly, the fermentation of events will force universities to act, forming a negative utility w. The probability of student netizens spreading isP_1, the probability of not spreading is$1 - P_1$, the probability of universities actively processing is $1 - P_2$, and the probability of negative processing is P_2.

3.1.2 Model establishment and solution

From the above assumptions of the model, it can be concluded that the benefit of student netizens' public opinion communication and universities' active response is a_1, the benefit of student netizens' public opinion communication and universities' negative response isa_2, the benefit of no communication and universities' active treatment is b, and the benefit of no communication and universities' negative treatment is $-b$. When public opinion occurs, the income of the university is $R - c_1$ regardless of whether the student netizen disseminates, while the income of the university is $R - c_2 - w$ when the student netizen disseminates but the university responds negatively. When student netizens do not spread and colleges and universities respond negatively, the income of colleges and universities is $R - c_2$. Therefore, the benefit matrix of each player can be obtained as shown in the table below.

Table 1. Game matrix between student netizens and universities

	positive	negative
spread	$(a_1, R - c_1)$	$(a_2, R - c_2 - w)$
do not spread	$(b, R - c_1)$	$(-b, R - c_2)$

The following is an analysis of the benefits of both sides of the game. From the game between student netizens and universities, it can be concluded that the game strategy choices are: (communication, positive response), (no communication, positive response), (communication, negative response) and (no communication, negative response). The following is a study of each variable to analyze how to reduce the probability P_2 of negative public opinion events in colleges and universities.

Suppose that the expected return of student netizens for public opinion dissemination is E_1, and the expected return of non-dissemination is E_2, then

$$E_1 = (1 - P_2)a_1 + P_2 a_2$$
$$E_2 = (1 - P_2)b - P_2 b$$

The probability selection of colleges and universities should make the expected returns of the two strategies of communication and non-communication the same, that is, when $E_1 = E_2$,

$$P_2 = \frac{a_1 - b}{a_1 - a_2 - 2b} \quad (1)$$

If the expected return of a university actively dealing with negative public opinion events is E_3, and the expected return of negative dealing is E_4, then

$$E_3 = P_1(R - c_1) + (1 - P_1)(R - c_1)$$
$$E_4 = P_1(R - c_2 - w) + (1 - P_1)(R - c_2)$$

The probabilistic choice of students' netizens should make the expected returns of the positive and negative strategies the same, that is, when $E_3 = E_4$,

$$P_1 = \frac{c_1 - c_2}{w} \quad (2)$$

In summary, the mixed strategy Nash equilibrium is:

$$\left(\frac{c_1 - c_2}{w}, \frac{w - c_1 + c_2}{w}\right), \left(\frac{a_1 - b}{a_1 - a_2 - 2b}, \frac{-b - a_2}{a_1 - a_2 - 2b}\right)$$

3.1.3 analyze

Generally speaking, if student netizens gain more benefits from the dissemination of public opinion in colleges and universities, the probability of colleges and universities not actively dealing with public opinion events is smaller. Using formula (1) to find the partial derivative of the income a_1 of student Internet users' communication, we can get:

$$\frac{dP_2}{da_1} = -\frac{a_2 + b}{(a_1 - a_2 - 2b)^2} < 0$$

It shows that the probability P_2 decreases with the increase of a_1, which verifies the conclusion.

If colleges and universities do not actively deal with public opinion events, the greater the negative utility, the smaller the probability of students to carry out public opinion communication. By using formula (2) to obtain the partial derivative of the disutility w received by universities, we can get:

$$\frac{dP_1}{dw} = -\frac{c_1 - c_2}{w^2} < 0$$

It is shown that probabilityP_1 decreases with the increase of w, and this conclusion is verified.

If the higher the cost of actively dealing with negative public opinion events, the greater the probability of students to carry out public opinion communication. By using formula (2), the costc_1 of universities actively dealing with public opinion events is deflected, and the following results are obtained:

$$\frac{dP_1}{dc_1} = \frac{1}{w} > 0$$

It is shown that probability P_1 increases with the increase of w, and this conclusion is verified.

3.2 THE MIXED GAME BEHAVIOR OF GOVERNMENT AND UNIVERSITY

Due to the existence of market failure and information asymmetry, colleges and universities have a greater probability of negatively dealing with negative public opinion events to avoid paying more costs. To this end, it is necessary to introduce the supervision mechanism of the government education department. If it is found that colleges and universities do not act on

their own negative events through the supervision of the government department, the punishment will be increased and the rectification cost will be increased. Students are usually in a vulnerable position, which is due to the lack of information between students and universities in their cognition of events and the unequal status between them, which creates distrust between students and universities. Students prefer to express their opinions anonymously on the Internet. Therefore, in the game of negative public opinion events in colleges and universities, it is necessary to introduce government supervision departments to strengthen supervision.

3.2.1 Hypothesis and symbol description

The two sides of the game are government departments and universities. It is assumed that all players are rational people, and all guide their behavior with the goal of maximizing their own interests. For the government, it is necessary to consider whether to strictly regulate the behavior of colleges and universities. When public opinion occurs, if the government strictly regulates, the corresponding supervision cost will be generated; if the government does not strictly regulate, there will be no cost. If the government strictly monitors and the university does not act actively, it will impose a penalty on the university. Therefore, the strategy set of government regulation is (strict regulation, not strict regulation). The university's strategy set is to deal with public opinion (positive, negative).

It is assumed that when the government strictly supervises, certain costs N will be incurred due to the establishment of corresponding supervisory departments and managers. If it is found that colleges and universities do not actively deal with public opinion events, the government will impose corresponding penalties, and its income will be $f - N$.For colleges and universities, if colleges and universities do not actively deal with it, the benefits are $R - c_2 - w - f$, including the rectification costs after the negative public opinion events ferment and the corresponding government penalties. The probability of strict supervision by the government is P_3, the probability of not strict supervision is $1 - P_3$, the probability of positive treatment by universities is $1 - P_4$, and the probability of negative treatment is P_4.

3.2.2 Model building and solving

According to the above assumptions of the model, when the government strictly regulates, its return is $-N$ and $f - N$ respectively, and if the government does not strictly regulate, its return is 0. When the government strictly supervises, the income of colleges and universities is $-c_1$ if they actively deal with it, and $R - c_2 - w - f$ if they don't actively deal with it. When the government does not strictly supervise, the benefit of active treatment is $R - c_1$, and the benefit of inactive treatment is $R - c_2$. Therefore, the benefit matrix of each player can be obtained as shown in the table below.

Table 2. Game matrix between government and universities

	positive	negative
strict	$(-N, R - c_1)$	$(f - N, R - c_2 - w - f)$
loose	$(0, R - c_1)$	$(0, R - c_2)$

The following is an analysis of the benefits of both sides of the game, and a message can still be obtained from the game between the government and universities: if the government does not strictly supervise, universities will still choose not to actively deal with public opinion events. The strategy choices of the game players are respectively (strict supervision, positive response), (not strict supervision, positive response) and (not strict supervision, negative

response). The following is a corresponding study of variables to analyze how to improve the probability of strict supervision by the government and the probability of active action by universities.

The expected return of a government department under strict supervision is E_3, and the expected return without strict supervision is E_4, then

$$E_3 = -N(1 - P_4) + P_4(f - N)$$
$$E_4 = 0$$

The probability selection of colleges and universities should make the expected returns of government departments choosing strict or not strict supervision strategies the same, that is, when $E_3 = E_4$,

$P_4 = \frac{N}{f}$(3)

If the expected return of a university actively dealing with negative public opinion events is E_5, and the expected return of negative dealing is E_6, then

$$E_5 = P_3(R - c_1) + (1 - P_3)(R - c_1)$$
$$E_6 = P_3(R - c_2 - w - f) + (1 - P_3)(R - c_2)$$

The probabilistic selection of government departments should make the expected benefits of positive treatment and negative treatment strategies the same, that is, when $E_5 = E_6$,

$$P_3 = \frac{c_1 - c_2}{N + f} \quad (4)$$

In summary, the mixed strategy Nash equilibrium is:

$$\left(\frac{c_1 - c_2}{N + f}, \frac{N + f - c_1 + c_2}{N + f}\right), \left(\frac{N}{f}, \frac{f - N}{f}\right)$$

3.2.3 analyze

It can be argued that the higher the penalty, the lower the probability of strict supervision by the government. Using formula (4) to obtain the partial derivative of university fine f, we can get:

$$\frac{dP_3}{df} = -\frac{c_1 - c_2}{(N + f)^2} < 0$$

It shows that the probability P_3 decreases with the increase of f, which verifies the conclusion.

The higher the cost of strict supervision by government departments, the greater the probability that universities will negatively deal with negative public opinion events. Formula (3) is used to obtain the partial derivative of government supervision cost N, and the following results are obtained:

$$\frac{dP_4}{dN} = \frac{1}{f} > 0$$

It shows that the probability P_4 increases with the increase of N, which verifies the conclusion.

The greater the cost difference between positive and negative handling of public opinion events, the greater the probability of strict supervision by government departments. By using formula (4), the cost difference $c_1 - c_2$ for colleges and universities to deal with public opinion events is obtained:

$$\frac{dP_3}{dc_1 - c_2} = \frac{1}{N + f} > 0$$

It shows that the probability P_3 increases with the increase of $c_1 - c_2$, which verifies the conclusion.

4.CONCLUSION

As an important part of social public opinion, public opinion in colleges and universities must attract widespread attention and attention from the public. From the analysis of the above game behaviors, it can be seen that in order to prevent the worsening of negative public opinion events in colleges and universities, we should start from many aspects, not only to solve the internal contradictions between students and colleges and universities, but also to build a bridge as a regulator to let students trust colleges and universities, and colleges and universities should take the initiative to deal with negative public opinion events.

Building trust and addressing students' demands.Usually, students' negative comments on online social platforms are mostly anonymous, which can indicate that there is a crisis of trust between students and schools. In the early stage, the negative public opinion on the social network of colleges and universities is conducive to students' safeguarding their own rights and interests to a certain extent, and it is also conducive to the university to further regulate management and protect the relevant interests of students. If universities do not face up to students' demands, the Internet will become a sword for the development of negative public opinion. Colleges and universities should collect opinions before formulating policies, such as holding student forums to consider students' opinions. Regular student discussion on campus life and study issues, timely feedback and solution of problems related to students' immediate interests, building a bond of mutual trust can effectively reduce the backlog of students' dissatisfaction.

Strengthen students' ideological construction.As the stakeholders of online public opinion in universities, student netizens sometimes fail to consider the adverse effects that may be brought about by negative remarks. Therefore, colleges and universities need to properly manage students who make inappropriate remarks and bear the consequences of their actions. Colleges and universities not only need to guide and educate students Internet users, but also educate students to learn to distinguish information, not to imitate others, and to keep a clear mind in the face of complex Internet information.

Improving laws and regulations and strengthening Internet supervision.

First of all, the government needs to strengthen network supervision to avoid the fierce development of public opinion incidents. It should play a guiding role in the negative public opinion incidents in colleges and universities, and build a bridge of communication between students netizens and colleges and universities to reduce supervision costs. Secondly, as a stakeholder of negative public opinion in colleges and universities, the government should establish and improve the laws and regulations on network norms and supervision of colleges and universities. After the occurrence of online public opinion events in colleges and

universities, different solutions should be adopted for the incidents of varying severity to make decisions as soon as possible and implement deployment, so as to solve negative online public opinion events in colleges and universities in a standardized, efficient and orderly manner.

.

REFERENCES

[1] Zeng Zhaohao et al. Theory and Practice of online public opinion guidance in universities [M]. Guilin: Guangxi Normal University Press, 2013:15. (in Chinese)

[2] Early Morning, Feng Junwen, Wu Peng, et al. Research on emergency response of online public opinion in universities based on SOAR model [J]. Chinese Journal of Information,2019,37(7):145-152. (in Chinese)

[3] Li Yiquan, Zhang Yangang. Research on simulation and countermeasures of resonance phenomenon of online public opinion in universities [J]. Journal of Information,2019,38(12):107-113. (in Chinese)

[4] Wen H Y. Research on the evolution law of online public opinion in universities based on the four-party evolution game [J]. Management Review, 2002,34(09):158-169. (in Chinese)

[5] Chen Fuji, Huang Jiangling. Research on the evolution of online public opinion from the perspective of three-party game [J]. Information Science,2015,33(09):22-26. (in Chinese)

[6] Long Yue, Liu Yiyang. Research on characteristics and paths of negative network public Opinion Propagation in universities under new media environment [J]. Information Science,2019,37(12):134-139. (in Chinese)

[7] Shen Shiqi. An evolutionary game analysis of negative online public opinion in universities based on SD [D]. Shandong University,2021. (in Chinese)