The Simulation Study of Spread and Evolution about Network Opinion on Education

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Abstract

This paper analyzed the participants of the communication of network opinion on education, built the evolution model of the communication of network opinion on education, designed the stimulation environment to conduct experiments and drew a conclusion based on NetLogo. At the same time, the paper presented three items that mainly made effect on the communication of network opinion on education: the opinions of BBS, the amounts of the first level nodes linked by interpersonal communication, and the amounts of the first level nodes linked by BBS.

Keywords: network, public opinion on education, NetLogo, simulation

1. Introduction

With the rapid development of Internet, network opinion was formed by people and that reflect the social atmosphere. Many scholars conduct researches about it, but which seldom addresses network opinion on education. Network opinion on education is the sum of views, opinions, thoughts, emotions, and attitudes hold by netizens and which are triggered by various aspects of the education sector, educational institutions, education system, education reform, and education events (Wang, 2011). Network opinion on education is subordinate to network opinion, but it has specific characteristics, such as non-profit, professional, and normative. Because of the anonymity of internet, the people express the opinions that they held directly without any apprehension and they can be taken into reference for education Decision-making (Zuo, Guo, & Zeng, 2011). At present, most researches about network opinion on education take the method of qualitative analysis. Zuo, Guo, and Zeng (2011) put forward the elements of network opinion on education, explain the connotation and characteristics of which, and reveals the meaning of the research on network opinion on education. Li, Li, & Jia (2011) compares network opinion on education to public opinion on education and held that it has these characteristics: freedom, controllability, interaction, immediacy etc. The above scholars define the connotation of network opinion on education and analyze the properties of that. But they are all the qualitative description without solving the problem of causality. Quantitative method, especially model and stimulation can make it clear that what are the elements of network opinion on education and how do they make effect on each other. Some research has address on network opinion by model and stimulation. Wu, Cheng, & Liu (2006) probes into the model and stimulation of public opinion under the influence of noise based on cellular automaton model. Fang, He, and Song (2012) build cooperative Markov models to predict the communication of network opinion. Tang developed the monitor system of network opinion to trace the real-time dynamics of peoples' opinion, reduce the negative effects, and shape the good image for enterprise or government. Nevertheless, there is no research on network opinion on education by model and stimulation. This paper analyzed the participants of the communication of network opinion on education, built the evolution model of the communication of network opinion on education, designed the stimulation environment to conduct experiments and drew a conclusion based on NetLogo.

2. The Evolution Model of Network Opinion on Education

Agent Based Modeling (ABM) has several advantages: initiative, hierarchy, dynamics, and operability (Chen, 2003). Multi-agent based modeling is to set many agents in computer software and make them interact complying with specific rules. We can explore the macro system law according to the whole micro action of

individuals and the macro phenomenon can be explained in reality (Zong, Gu, & Sun, 2010). The re-communication of network opinion on education can be divided into three categories: interpersonal re-communication, group re-communication, and forum re-communication (Qian, 2008). Interpersonal re-communication means that the receiver of network opinion on education will transmit the information to finite individuals by instant message tools and e-Mail with the method of one to one. Group re-communication is that the receiver of network opinion on education repeats the information to BBS or Blog and the communication method is also one to one. Forum re-communication is the specific communication method of group re-communication, and it refers to that people search for opinion information on education from BBS, community and Blog, so the communication method is one to many.

There are two kinds of participants, one is forum and the other is individual. Forum includes post bar, BBS, and other kinds of web platform. Individual refers to netizens, which can be divided into immune, interpersonal re-communicator, and group re-communicator. The immune won't forward the opinion information after received it. The interpersonal re-communicator transmits the information to other individuals one by one when they get it. The group re-communicator will release opinion information after they took it.

After analyze the participants, we present the model of spread and evolution about network opinion on education, as shown in Figure 1. Firstly, the internet forum, the origin of network opinion, releases the opinion information received by individuals. Secondly, the individuals generated by the internet forum will come to be communicators or immunes after obtaining opinion information about the event. The object of interpersonal re-communicator is the new individual and the group re-communicator is the internet forum. Thirdly, both interpersonal re-communicators and internet forum generate the new individual, which will join the next round of communication. During the communication of network opinion on education, the individuals include interpersonal re-communicators, group re-communicators, and the immunes. They will interchange the opinion information all the time and their opinions may change from negative to positive or vice-versa. Once the opinions changes, the new generated individuals by them will inherit the new opinion. The dash line in Figure 1 shows the communication relationship among them.
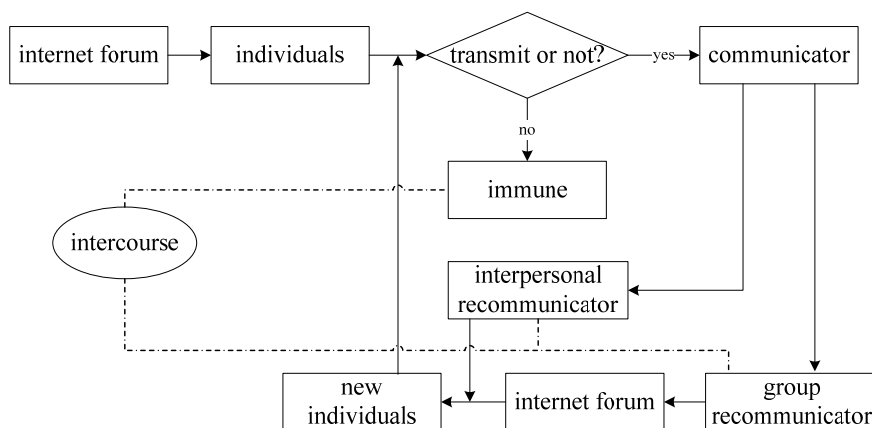

Figure 1. The model of spread and evolution about network opinion on education

3. The Stimulation of Spread and Evolution about Network Opinion on Education

3.1 The Aim and Hypothesis

The aim is to stimulate the evolution process of individuals and internet forum during the communication of network opinion on education and investigate the influence factors. The following hypothesizes were raised based on the behavior patterns of agents: there are only two origins of network opinion released on internet forum, one is positive, the other is negative; the participators of network opinion on education also can be divided into the positive and the negative; the time unit can be subdivided into time units infinitely and every unit corresponds one stimulation; the sum of internet forum is less than six.

3.2 The Definition of Agent

We defined three kinds of agents in NetLogo: 1) turtles, which delegate the participants for network opinion on education and can be categorized into internet forum, interpersonal re-communicator, group re-communicator, and immune; 2) links, which connects turtles, and delegate the communication relation of network opinion on

education; 3) observers, who control the stimulation process, and give the result. Because the characteristics and interaction rules of turtles play the key role in this research, the following agent refers to the turtles. There are two kinds of attributes for agent: one is the probability of behavioral decisions of agents, the other is the intermediate variable during the stimulation process. Table 1 shows the attributes and descriptions of agent.

Table 1. The attributes and descriptions of agent

Attribute	Description
P-R-Group	The probability of the agent choosing group re-communication
Is Group	Whether chose group re-communication or not
Is Group New	Whether it is the node linked by group re-communicator or not
P-R-Several	The probability of the agent choosing interpersonal re-communication
Is Several	Whether chose interpersonal re-communication or not
Is Several New	Whether it is the node linked by interpersonal re-communicator or not
Num Of Several Link	The sum of the first level of nodes linked by interpersonal re-communicator
P-R-Immune	The probability of the agent becoming the immune
Is Immune	Whether it is the immune or not
Is Center	Whether it is the internet forum node or not
Is Center New	Whether it is the node linked by internet forum node or not
Num Of Center Link	The sum of the first level of nodes linked by the internet forum node
Is Communicated	Whether it is communicated chosed by the agent
Run-times	The interaction times
Tnum	The life cycle of the interaction among agents
Kind	The kinds of agents
Opinion	The opinion of agents, positive or negative

The probability of behavioral decisions of agents is the most important attribute that determines whether it chooses to be re-communicator and the re-communicated individual type. In this paper, P-R-Several, P-R-Group, and P-R-Immune are all the probability of behavioral decisions of agents and they are set to be the adjustable parameter. Because the memory about something will decay as time went by, the probability of re-communication of individuals and groups will decrease over time. Therefore, the probability of re-communication will multiply the Recession coefficient r in every time unit. The adjustable parameters, Num Of Several Link and Num Of Center Link, are put forward because of the limitation of the first level node by individual and internet forum.

3.3 The Interaction Rules among Agents

The interaction rules include the rule among individual agents themselves and the rule between individual agents and internet forum.

3.3.1 The Interaction Rule among Individual Agents

The interaction action among individual agents mainly contains the flow of information caused by interpersonal re-communication and the transformation of opinions generated by the communication. The mechanism of interpersonal re-communication is the following: the probability of individual interpersonal re-communication is compared to the random number ranging from 0 to 1 once stimulating, and if the probability is greater than the random number, the individual agent will choose to re-communicate interpersonally with the receiver including the immune, re-communicator, and group re-communicator. The mechanism of the transformation of opinions was defined: after the two individuals communicated, the opinion value of each one is averaged according to the sum of theirs, and the individual agent will stop communicating within limited times.

3.3.2 The Interaction Rule between Individual Agents and Internet Forum Agent

The interaction between individual agents and internet forum agents is the flow of information generated by group re-communication and internet forum re-communication. The mechanism about Whether the individual agent chooses group re-communication is defined as follow: the probability of group re-communication is compared to the random number ranging from 0 to 1 once stimulating, and if the probability is greater than the

random number, the individual agent would forward information to internet forum, the group re-communicator, which inherits the opinions of the individual agent. The mechanism of internet forum re-communication is the following: on every stimulating time, the internet forum will transmit information to two individual agents and they inherit its opinion value, which cover interpersonal re-communicator, group re-communicator, and the immune.

3.4 The Stimulation Algorithm

The communication net of network opinion on education is the result of the execution of the stimulation algorithm step by step in which the individual changes state continuously on NetLogo.

Agent i move randomly to communicate with the nearby agent j on every step length based on Deffuant theory. At the time t, xi(t) indicates the opinion of agent I and xj(t) indicates the opinion of agent j. The evolution rule is the following: if two individuals communicated, the opinion value of each one is averaged according to the sum of theirs. The running process of the algorithm is shown in Figure 2.
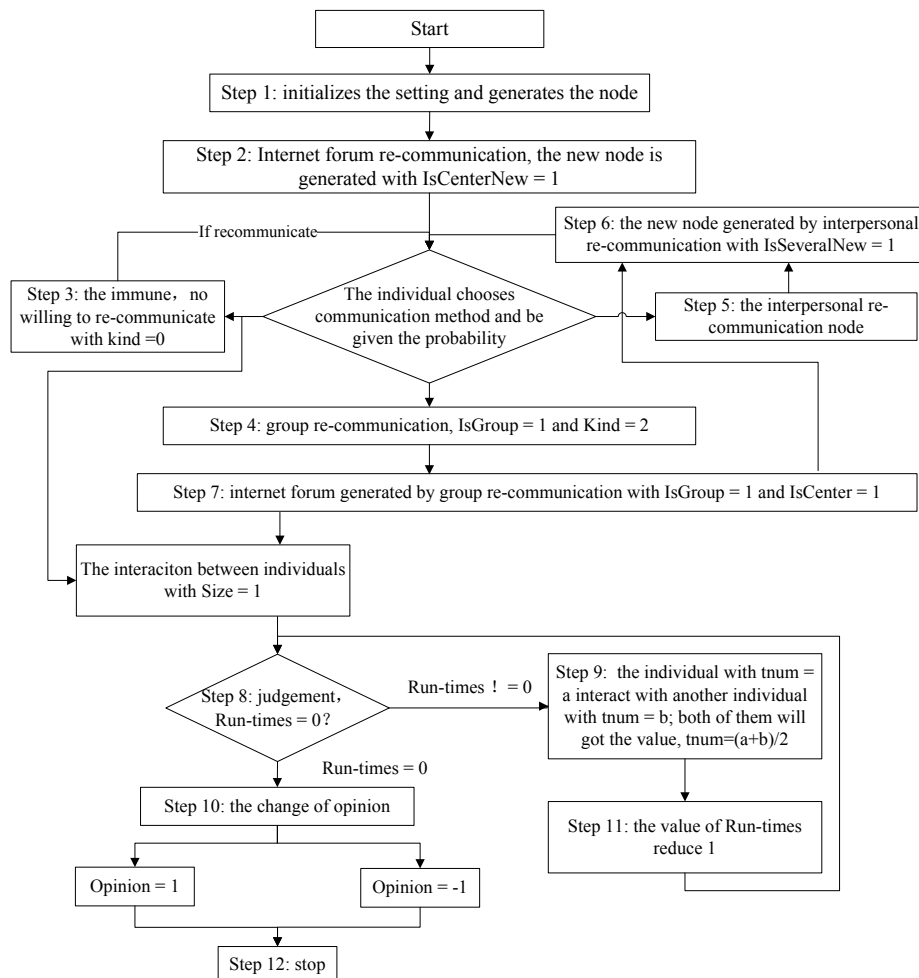

Figure 2. The running process of the algorithm

The steps of algorithm are the following.

Step 1: initializes the setting and generates the node. Is Center is set at 1, and Kind set at 3.

Step 2: as the internet forum agent, the node of is Center generated a new node with size = 1. Is Center New is set at 1, and the new node will be assigned the probability of individual communication.

Step 3: whether the node is the immune or not; if Is Several = 0, Is Group = 0, and Kind = 0, the node is the immune; otherwise, it will be judged again.

Step 4: whether the node is the group re-communicator; if Is Group = 1 and Kind = 2, it is the group

re-communicator and is Center New is set at 0; otherwise, it will be judged again.

Step 5: whether the node is the interpersonal re-communicator; if Is Several = 1 and Kind = 1, it is the interpersonal re-communicator and is Center New is set at 0; otherwise, it will be judged again.

Step 6: interpersonal re-communicator generated the new node with Size = 1; is Several New of the new node was set at 1, which links the individual with is Several = 1 and will be judged about the individual type.

Step 7: group re-communicator generated the new internet forum node with Size = 3; is Group New of the new node was set at 1 and is Center was set at 1, which links the individual with is Group = 1 and will go to step 2.

Step 8: judge the individual with Size = 1; if run-times = 0, go to step 10; if rum-times! = 0, then go to step 9.

Step 9: at the same place, the individual with tnum = a and run-times! = 0 communicate with another individual with tnum = b and run-times! = 0; both of them will got the value, tnum = (a+b)/2, and go to step 11.

Step 10: the change of opinion; if tnum > 0, then opinion = 1; if tnum < 0, then opinion = -1; the probability of opinion = 1 and opinion = -1 is 0.5 and then goes to step 12.

Step 11: the communication times reduce 1; after communication, the run-times of each individual will cut down 1.

Step 12: the individual stop communicating; the individual completing step 10 will stop moving.

3.5 The Result and Discussion of the Stimulation

According to the requirements of application in the field of context stimulation, it is important to run the model and the stimulation program for many times to get the reasonable value of the modeling parameter. Therefore, the model system and stimulation program run for testability and be rectified for many times based on the communication characteristics of network opinion on education, which leads to the adaptable value for related parameters. The interface of the main program is shown in Figure 3.
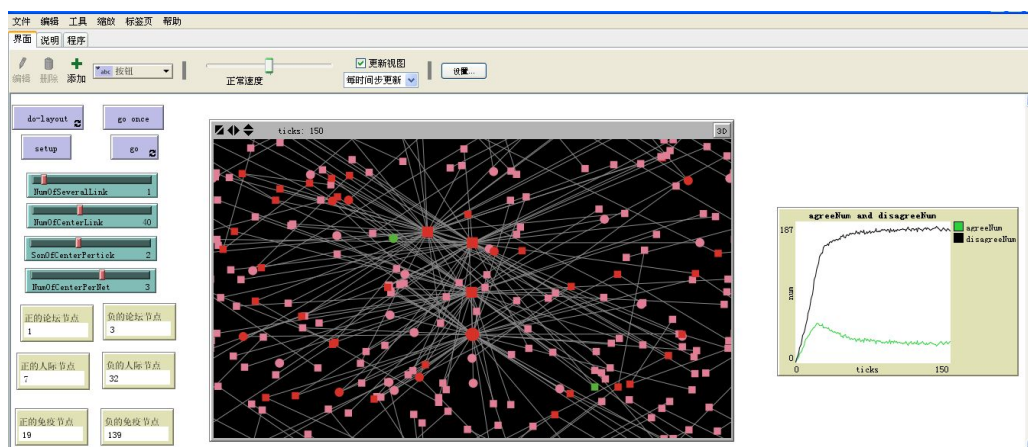

Figure 3. The interface of the main program

The first level node and internet forum node play pivotal role in the development of network opinion on education. We take these nodes as the research objects, adjust one parameter with the control of other parameter, and get the result. After running the stimulation program repeatedly, the most representative Figure about the changing amount was analyzed and the influence items of network opinion on education were concluded.

3.5.1 The Amount of the First Level Node Linked by Internet Forum Node with Disagreement

With other items being controlled, the value of Num Of Center Link of the node network with disagreement was set to be 60, 40, and 20 respectively. The node with agreement ratio shows in Figure 4(a), (b), and (c), in which the green line indicates the amount of the positive nodes and the black line indicates the amount of the negative nodes. As can be seen from Figure 5, the smaller the amount of the first level nodes linked by internet forum node from the node network with disagreement is, the agents with disagreement get fewer. Thus, in order to control the tendency of network opinion on education to disagreement, it is the effective method of taking measures to reduce the views of internet forum with disagreement.
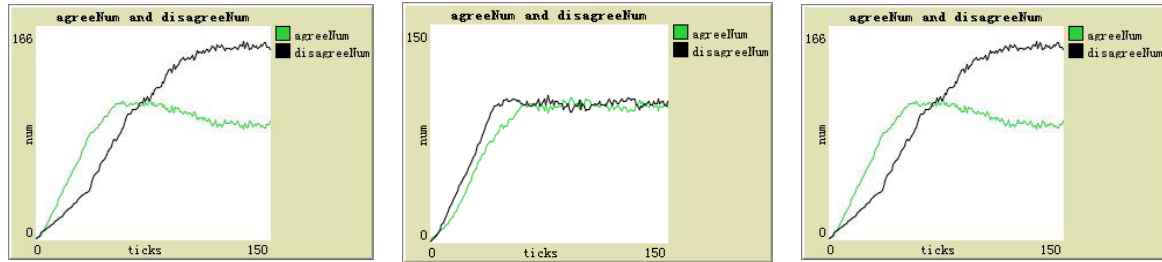
(a)Num Of Center Link = 60   (b) Num Of Center Link = 40   (c) Num Of Center Link = 20

Figure 4. The amount of node with various value of Num Of Center Link

3.5.2 The Amount of the First Level Nodes Linked by Interpersonal Re-Communication Node

With other items being controlled, the results shows in Figure 5(a), (b), and (c) when changing the value of Num Of Several Link of the node network; the green line shows the amount of the agents with agreement and the black line shows the amount of the agents with disagreement. As can be seen from Figure 6, the smaller the amount of the first level nodes linked by interpersonal communication node from the node network with disagreement is, the agents with disagreement get fewer. Comparing Figure 4 with Figure 5, it shows that the effect of Num Of Several Link is more significant than that of Num Of Center Link. Therefore, the way of controlling the tendency of network opinion on education to disagreement is to reduce the communication times of interpersonal re-communication node with disagreement or add the interpersonal re-communication nodes.
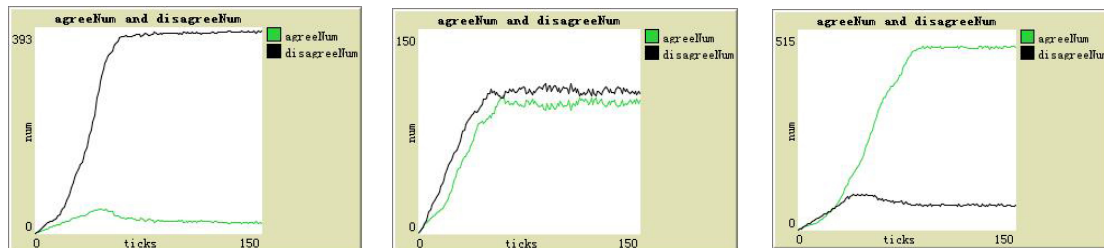

(a) The network of the nodes with disagreement: Num Of Several Link = 5; The network of the nodes with agreement: Num Of Several Link = 1

(b) The network of the nodes with disagreement: Num Of Several Link = 1; The network of the nodes with agreement: Num Of Several Link = 1

(c) The network of the nodes with disagreement: Num Of Several Link = 1; The network of the nodes with agreement: Num Of Several Link = 5

Figure 5. The amount of nodes with various value of Num Of Several Link

3.5.3 The Amount of Internet Forum Node

With other items being controlled, the results shows in Figure 6(a), (b), and (c) when changing the combination value of the amount of internet forum nodes with agreement and the amount of internet forum nodes with disagreement; the green line shows the amount of the agents with agreement and the black line shows the amount of the agents with disagreement. As can be seen from Figure 6, if the amount of internet forum nodes with agreement is bigger than the amount of internet forum nodes with disagreement, the communication network of network opinion on education is positive and vice versa. Consequently, the third method of controlling the tendency of network opinion on education to disagreement is to reduce the internet forum nodes with disagreement or add the internet forum nodes with agreement.
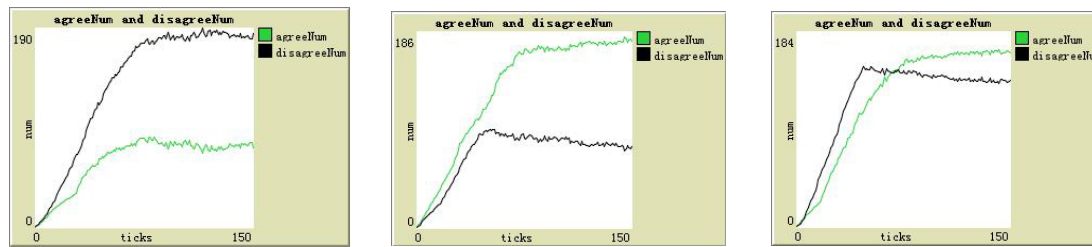
(a) The amount of internet forum nodes with agreement = 2; The amount of internet forum nodes with disagreement = 3

(b) The amount of internet forum nodes with agreement = 3; The amount of internet forum nodes with disagreement = 2

(c) The amount of internet forum nodes with agreement = 3; The amount of internet forum nodes with disagreement = 3

Figure 6. The amount of nodes with the various amounts of internet forum nodes

4. Conclusion

By modeling the evolution of network opinion on education and through the stimulation in NetLogo, the influence items about the tendency of network opinion on education to disagreement includes the position of internet forum nodes, the amount of the first level nodes linked by interpersonal re-communication nodes, and the amount of the first level nodes linked by internet forum re-communication nodes. The present study may be criticized for which no consideration is being taken to the self-factor of network opinion on education while it is very important for the stimulation of closing to the reality during the process of modeling and stimulation. Future work should focus on improving the evolution model of network opinion on education and predicting the trend of network opinion on education.

Acknowledgements

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