Research on Collaborative Teaching Based on Social Network Analysis

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Abstract. Collaborative learning is one of the methods that college students improve their learning outcome. For purpose of this paper, a class of E-commerce majors of Grade 2015 were taken as the experimental subjects to introduce social network analysis method into teaching research, learn about the network structure consisting of emotion relationship, information communication and course counseling relationship among students of the class by means of questionnaire survey, analyze the behavior characteristics of learners on this basis, build learning team, assign collaborative learning tasks, and implement collaborative teaching. A comparison of the density, average degree and centralization of the graph before and after implementing collaborative learning shows that collaborative teaching based on social network analysis is helpful to improve academic atmosphere, raise the cohesive force of class, and enhance learning outcome. Besides, some suggestions on promoting the application of collaborative teaching were proposed.

Introduction

With the development of the mobile Internet and information technology in education, the academic environment of the college students has significantly changed. Their learning behavior could be affected by such social factors like individual emotion and network communication, and the traditional learners have evolved into socialized learning community. Long-term teaching practice shows that the more frequently the college students mutually help and communicate with each other, the more closely they study cooperatively and the greater the mount of knowledge and skills they acquire, the better learning effects they will get. Therefore, improving the teaching model which taught only by teachers in class and giving full play to the advantage of collaborative learning become one of the central topics of the teaching reform. However, the fact is that the teachers’ cognition towards the collaborative teaching still numerously remains on the experimental analysis. There is rarely empirical study that could verify the collaborative learning on promoting communication, maintaining close ties and improving teaching efficiency. This article analyzes the collaborative teaching process from the perspective of social network by knowing about the learning behavior and features of the learners and making and implementing the collaborative teaching plans. In conclusion, it’s important to compare the different effects before and after implementing the collaborative teaching and also give some suggestions for the improvement of teaching.

Developing and Implementing a Collaborative Teaching Program

Based on the analysis towards the learners, it could be judged that there exists a strong homogeneity tendency in communicating. The boundaries between boys and girls are obvious, whether information communication or course discussion. And some of the members are still in a position of the edge. This is related to personality, but also related to the attitude towards specialty learning. Over all, the whole academic learning atmosphere of the class is wanting. Therefore, the goal of the collaborative teaching is to establish the appropriate learning group, build the online learning community, create various opportunities to communicate emotion, share knowledge and exchange maturely, developing a learning network that has a bigger density and a wider combining and promoting all the students to make progress together.
Establishing Learning Groups

The learning group with mutual help and efficiency is the premise and basis to carry out the collaborative learning, in which its quality will influence the effects of collaborative learning. There are three grouping methods generally such as, the first, intergroup heterogeneity and group homogeneous, the second, intergroup homogeneous and group heterogeneity, and the third, Freedom combination and dynamic generation. This paper is on the principle of intergroup homogeneous and group heterogeneity. Then the new connotation of "quality" could be given by the analyzing the social network of the learners, including not only individual’s learning ability and personalities, but also the position he occupies, the strength of the interactions and the roles he plays in a small group, and so forth.

By analyzing the social network diagram, teachers could see all the information clearly, such as the one he has asked for help of each student and which students he has been turned for help, his location in this network, the contacts and the strength of the interactions, and the determination of the centrality and betweenness, etc. Giving each member a certain role accordingly, they may be the opinion leader, the active learner, a talent of information dissemination and helping others to learn, etc. when grouping, the students who are weak in learning initiative could be arranged with the students with good initiative in learning in one group; the students who are delighted to transmit and share the knowledge could be arranged with those students in the edge position in one group and the higher centrality could be matched with the lower centrality, with boys and girls in each group. The one who is active and good at communicating could be responsible for the whole group. Each group with 3-5 students is appropriate, because a few student and many groups is difficult to manage, while it is difficult to balance with large number of people when distributing learning task.

Distributing Learning Task

In the course of collaborative teaching, teachers should organize the students to learn independently and collaboratively with members in groups and then complete of the learning task, at last construct the curriculum knowledge system. The setting of the learning tasks should be arranged in some slope and hierarchy, which could satisfy the students with different start-points and knowledge levels and in addition, guiding students to explore and think deeply in the task.

Taking E-commerce course as an example, the content is divided into a number of knowledge points according to the order of chapters, and each knowledge point lists such three completion index as know, understand and use which are given corresponding value. What’s more, different types of learning tasks should be arranged such as exercises, curriculum design and after-school study. The students should be organized to learn independently and collaboratively with members in groups. The progress of the members is counted and reported weekly. In addition, teachers should publish the learning progress of each group, organize to carry out learning competitions and have them make mutual comments among groups and research and answer the difficulties online. In order to guarantee the students could make fully interaction in the group study, the main contents of the evaluation should include the participation in online discussions, the group collaboration to complete tasks, the group members' self-evaluation and mutual evaluation, etc.

Analysis of the Influence of Cooperative Teaching on Learning Effectiveness

To compare the effects of cooperative teaching before and after the implementation on the learning, at the end of the term, the author conducted a second survey of questionnaires in the class participating in the experiment. The questions include three areas. Firstly, which students you have turned for help when faced with difficulties in your course after grouping. Secondly, which students you have helped or guided after grouping. Thirdly, which students you communicate with more closely after grouping. The state of the academic advisory and the information communication of are mastered after the class accepting the collaborative teaching by questionnaire, at last establishing two relation matrix of the network.
The Influence of Collaborative Teaching on the Study Style of the Class

The academic advisory has a strong correlation with the study style of the class. The more intensive the network is, the higher the efficiency of knowledge disseminate is. Thus the overall effectiveness of classroom learning will be improved. After selecting typical indexes such as the network density, the connection number, the average degree, the network potential center and so on. The compared value of academic counseling network before and after collaborative learning is showed in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Density</th>
<th>Connection number</th>
<th>Average degree</th>
<th>Network potential center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>0.0996</td>
<td>140</td>
<td>5.263</td>
<td>0.192</td>
</tr>
<tr>
<td>After</td>
<td>0.1501</td>
<td>211</td>
<td>7.158</td>
<td>0.167</td>
</tr>
</tbody>
</table>

Figure 1. The comparison of academic counseling network before and after collaborating teaching of the class.

After the collaborating teaching, the network density has risen from 0.0996 to 0.1501, compared before the collaborating, up by 50.7%. The connection number increased from 140 to 211, and the average degree promoted from 5.263 to 7.158, up by 36%. While the network potential center advanced from 0.192 to 0.194, down by 13%. The advancing of the density, the connection number and the average degree demonstrates that after carrying out the collaborative teaching, there are many more classmates taking part in the academic discussion, the number of asking and mutual learning is increased obviously. What’s the more important is the promotion of the study style of the class. The decline of the network potential center shows that comparing to the focus of a few central leaders in the academic advisory before collaborating, there are so many active learners and members willing to help others after the collaborative teaching.

The Influence of Collaborative Teaching on Class Cohesion

The average distance of the information-delivery between any two students in the network before the collaborative learning is 3.27, and after that it falls to 2.32. The reducing of the average distance means that communicating is more smoothly and transformation is faster. The cohesive degree index represents class cohesion, which soared from 0.366 to 0.507, up by 38.5%, demonstrating the information-delivery has developed into multilateral and bilateral exchange from the mainly bilateral exchange originally because of many more students participating in the communicating. The homogeneous degree of communicating called EI increased from -0.769 to -0.622, up by 19.1%, showing there are some changes in the communicating that boys and girls were limited to exchange in their respective groups before, because they begin to communicate with each other more. The average of click-out rate increased from 4.55 to 6.132 means the number of channel which each member gets information increased by 1.58. Finally, synthesizing the above indexes, it could be concluded that the class information communication network has a clearly Small World effect, the communicating is smoothly, the one-way exchange transferred into multilateral and bilateral exchange and the information could be transmitted at a faster speed. The comparing data are shown in the following table 2.
Table 2. The indexes comparison of information communication network before and after collaborating.

<table>
<thead>
<tr>
<th></th>
<th>Average distance</th>
<th>Average degrees</th>
<th>Homogeneous</th>
<th>Cohesive degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>before</td>
<td>3.27</td>
<td>4.55</td>
<td>-0.769</td>
<td>0.366</td>
</tr>
<tr>
<td>after</td>
<td>2.32</td>
<td>6.13</td>
<td>-0.622</td>
<td>0.507</td>
</tr>
</tbody>
</table>

Figure 2. The comparison of information communication network before and after collaborating teaching of the class.

The Correlation Analysis of the Information Communication and Academic Advisory

The various indexes of the information communication and academic advisory has changed better a lot after the collaborative learning, developing a good learning atmosphere and a strong cohesion. Whether the class’s cohesion and the learning atmosphere has a relativity or not and what the extent of relativity is. If they have a strong relativity, teachers could make corresponding strategy so as to organize and guide teaching. The relativity of the relation matrix between the information communication and academic advisory network is analyzed by adopting the measure of QAP. The result is shown in the following table 3.

Table 3. The correlation analysis of the information communication and academic advisory.

<table>
<thead>
<tr>
<th>Obs Value</th>
<th>Significant</th>
<th>Average</th>
<th>Std Dev</th>
<th>Prop&gt;=0</th>
<th>Prop=&lt;1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.654</td>
<td>0.000</td>
<td>-0.000</td>
<td>0.032</td>
<td>0.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

In the table 3, the significant level of the correlation is 0.000, showing that there is a little difference between the exchange network and the counseling network, but not remarkable. The correlation of Pearson is 0.654, there is a positive and strong correlation between the two networks. By analyzing the above data, it could be concluded that for this compulsory course called E-commerce, the exchange among students in and after class is mainly focus on the academic learning and discuss with each other about some topics together. It can be known that the collaborative learning strengthens the connection among students and has a positive effect on their learning and mutually assistance. Therefore, teachers could increase the frequency that students exchange and discuss with each other appropriately, after class guide the students to take part in the online discussion so as to promote the learning atmosphere by exchanging and guide the communicating through the outstanding learning atmosphere.

The Comparative Studies of the Learning Effect

Limited to the teaching arrangement, the E-commerce course on has one class in 2016, so the controlled trials of the collaborative teaching can’t be carried out. Therefore, what’s the most intuitive measure is compare and analyze the final written test scores in 2015 with that in 2016 towards the class of the same major. It can be seen that the course pass rate has risen markedly from 56.2% to 78% after implementing the collaborative teaching when the two exams in the same difficulty. In 2016, the number of students in the high score section (above 80) reached 10, accounting for 24.4%, while there was only one student in the high score section, accounting for 2.6%. What’s more, the average score of the class has risen from 55 to 70.8.
Table 4. The comparison of the learning effect between the collaborating learning and the non- collaborating learning.

<table>
<thead>
<tr>
<th></th>
<th>Below 60</th>
<th>60-69</th>
<th>70-79</th>
<th>80-89</th>
<th>90-100</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>43.8%</td>
<td>38.3%</td>
<td>12.3%</td>
<td>2.6%</td>
<td>0%</td>
<td>65</td>
</tr>
<tr>
<td>2016</td>
<td>22%</td>
<td>24.4%</td>
<td>29.3%</td>
<td>17.1%</td>
<td>7.3%</td>
<td>75.8</td>
</tr>
</tbody>
</table>

Summary

The study of the contemporary college students is not an individual student any more. Nowadays, their learning course is embedded in the various kinds of social networks and influenced by the network environment deeply. Teachers analyzed the social network through quantitative case study and also used the qualitative analysis. Then what’s the important is to observe the learner behavior from the form the view of structure, make teaching designs and draft teaching scheme so as to advance the teaching effect, which is the new thought of researching teaching. Concerning carrying out the collaborative teaching by adopting the social network analysis, this paper gives the several following suggestions.

Firstly, teachers should communicate with students more often, guide the students in the edge position to take part in the collaborative learning, carefully design the discussing topics and teaching tasks, inspire students' learning interest and promote the class members to exchange and collaboration. Secondly, teachers should inspire the core figure’s initiatives about collaborative learning, play the role as a guidance and bridge, making them communicate with the students in the edge position and making efforts to have all the participates make progress in the collaborative learning. Lastly, teachers could use the Internet tools like QQ groups, online forums, collaborative software and so on to build an equal and open platform to communicate and to cooperate. The teacher-student and the student-student are the transmitter and the acceptor of the knowledge mutually, fully promoting the enthusiasm and initiatives of student's learning.

Certainly, there still exists limitation about the collaborative teaching based on the social network. The effect of this measure is much more obviously for the class with the similar professional backgrounds and easily organized small group interactive teaching. In addition, the analysis towards the social network is static. How to reflect the class social network situation dynamically and work out adapted teaching plans are to be dealt with in the following research.

Acknowledgement

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References