International Journal of Computer Information Systems and Industrial Management Applications
ISSN 2150-7988 Volume 18 (2026) pp. 1-14

https://doi.org/10.70917/ijcisim-2026-0393
Article

Research on the Innovation of College English Teaching Based on Blended Learning Model

Siyuan Yuan [1,*]

[1] School of Foreign Languages，Henan University of Animal Husbandry and Economy, Zhengzhou, Henan 450000
* Correspondence author: helenysy@126.com

Abstract: In college teaching, college English still has some problems in classroom interaction, course content and teaching mode. In response to these challenges, blended learning has emerged as an emerging teaching mode. This paper integrates the blended learning mode in college English classroom for teaching innovation. It also takes the online classroom of a college English course in a freshman class of a university as the research object, and utilizes the UCINET social network analysis tool to study the network structure of interactive learning of college English under this mode. Teacher 1 had 1248 interactions in the course discussion forum, and 95% of the students had 100 or more interactions, with the lowest number of interactions reaching 80. It shows that the hybrid course has a high frequency of interaction. The eigenvector centrality value of Teacher 1 is 0.671, indicating that the teacher is the most central member of the online classroom. Students 14, 18, 3, 12, 20, 7, and 4 all have nEigenvec values of 20 or more, indicating that they are more central figures in the online classroom. The analysis of the factions of the sub-structures within the social network shows that Teacher 1 and Students 22, 25, and 28 appear several times in different subgroups, indicating that these four have more frequent interactions with other actors and are the core actors in the synchronous online classroom. The results of the study show that the innovation of college English teaching in blended mode proposed in this paper has strong feasibility and can help students better participate in the classroom and communicate with the teacher.

Keywords: blended learning; university English; social network; UCINET

1. Introduction

Under the educational background of the deep integration of information technology and education and teaching, college English teaching needs to enhance the connotation and realize the paradigm transformation of teaching and learning [1-2]. Blended teaching provides a continuity of innovative ideas for the current classroom teaching reform [3]. University English courses should adopt task-based, cooperative, project-based, inquiry-based and other teaching methods to implement blended teaching modes such as flipped classroom based on classroom and online online courses, which embodies the teaching concept of teacher-led and student-led [4-7]. Therefore, exploring the design ideas and implementation process of blended teaching in university English courses can provide some experiences for the reform of university English.

In the past, English teaching in universities is often to explain English knowledge to students in fixed classrooms [8]. This teaching mode makes the teaching time more centralized, which seriously affects the depth and breadth of learners' learning and is not conducive to learners' mastery of more English knowledge [9-10]. At the same time, in terms of after-class supervision, teachers can not well

control the learners' situation dynamically, resulting in the quality and level of English teaching not guaranteed [11-12]. The hybrid teaching mode based on the online teaching platform and offline course education is effectively applied in college English courses. Teachers can monitor and control learners' learning progress, as well as task points with the support of information technology [13-15]. In this way, teachers have a more comprehensive understanding of students' learning, and also make dynamic adjustments on this basis, which guarantees the effectiveness of English teaching, and makes the form of university English teaching enriched and innovative [16-17].

In the online classroom, learners will gradually form a certain social network through various communication platforms to exchange emotions, transfer information, and share knowledge, and the social network is an important foundation of the online classroom equivalent to the interaction mode of the online classroom, which can help us to understand the relationships that exist between the members of the online classroom as well as the interaction behaviors among the members. This paper develops an introduction to the overall network structure of social networks, including visualized directed community graph and social network density, and the concept of centrality. It also describes and analyzes the indicator sets of social network centrality: point centrality, mediator centrality, and proximity centrality. An algorithm for social network distance and diameter is also presented. Taking the college English online classroom under the blended learning mode of a university as the research object, the social network analysis method is adopted to analyze the learners' interaction behavior in the online classroom on the basis of describing the social network of the online classroom.

2. Hybrid Great Britain Teaching Model and Social Network Analysis

2.1. Construction of a hybrid teaching model

The purpose of this section is to describe a blended learning model for teaching listening and speaking. It provides students with ample opportunities for listening and speaking practice through a variety of teaching methods, integrating multimedia technology into face-to-face classes, and combining online applications such as “ISHOW Repeater” and “Foreigner's Interesting Dubbing”. Tool; Collectively, it has four main teaching objectives: "Listening" – by playing a video or a recording of the listening on a computer: "Imitation" – learning the intonation of students' voices in combination with an online learning app: "Showing" – being confident and presenting yourself in front of others:

“Immersion” - allows students to invade the English classroom and use English flexibly. Meanwhile, the teaching materials of the blended learning course are divided into two parts: paper textbooks such as “New Communication: English for International Communication” and Internet software such as computers, online learning apps, PPTs and videos, projectors, and course emails. For different teaching objectives and contents, these teaching resources can be fully and synchronously used in different teaching sessions.

2.2. Social network analysis

A social network is a collection of social actors and the relationships between them. Social network analysis is a methodology that explains social phenomena by analyzing the mutual interactions between actors. This method of analysis is based on mathematical graph theory, which allows the network structure of interactive activities to be presented in the form of images to visualize the interactive relationships. Social network analysis mainly includes two aspects such as overall network structure analysis and centrality analysis.

2.2.1. Analysis of overall network structure

(1) Visualizing Directed Community Graphs

A community graph is an effective representation of a network of relationships and is the main interaction data analysis method for social network analysis. A community graph consists of nodes and edges that represent relationship patterns. Among them, the nodes represent the interacting actors and the edges represent the relationships between the actors and the actors. The most important feature of the social graph is that it can visualize the relationships between actors.

(2) Social Network Density

The ratio of the actual number of connections in an interaction network to its allowed number of connections is the density, which reflects the intimacy of interaction and communication between participants in a social network. In the interaction network, the higher the network density means the more frequent the interaction, the closer the learners are connected, and the learners' cooperative learning behavior will be smoother and easier to achieve better results. According to the social

constructivism theory system, the construction of knowledge comes from social interaction, the more closely connected the interaction network, the more frequent the flow of knowledge, the easier it is for students to construct their own knowledge system.

2.2.2. Centrality analysis

Centrality is an important indicator for social network analysis. Centrality describes what kind of position and what kind of rights an individual has in a group. It is important for analyzing the degree of participation and learning engagement of individuals in interactive learning among online course learners. There are three types of centrality indicators commonly used in social network analysis: degree centrality, intermediate centrality, and near centrality.

2.3. Social Network Centrality Analysis Indicator Set

2.3.1. Point centering

Point degree centrality is the simplest and most intuitive indicator, which means that a node in a social network graph is in a more central position relative to other nodes if it is directly connected to many other nodes. The simplest and most direct way to measure the centrality of a node is to calculate the degree of the node, and a high degree of the node indicates that it is in the center. Point centrality can be subdivided into absolute point centrality and relative point centrality.

In an undirected network graph, the absolute point degree centrality formula is expressed as:

$$C_D\left(n_i\right)=d\left(n_j\right)=\sum_j X_{ij}=\sum_j X_{ij} \tag{1}$$

Where n_i represents a node in the network graph, X_{ij} takes the value of $\{0,1\}$, and 1 represents that node j has a direct connection with node i. Equation (1) is to sum up the degrees of the nodes, and the number of nodes in different networks will be different, in order to analyze the differences in the centrality of nodes' point degrees in different networks, it is necessary to standardize the centrality of the point degrees in order to do the comparison between different networks. The relative centrality of nodes is expressed by the formula:

$$C_D'=\frac{d\left(n_j\right)}{N-1} \tag{2}$$

Where N denotes the total number of nodes in the network and the maximum degree of any node is $N-1$.

In directed graph, point degree centrality is divided into outward point degree centrality and inward point degree centrality, and outward point degree centrality is the sum of the number of nodes recognizing the external relations, and the calculation formula is expressed as:

$$C_{Do}\left(n_i\right)=d_o\left(n_i\right)=\sum_{j=1} X_{ij} \tag{3}$$

The standardized formula is:

$$C_{DO}'\left(n_i\right)=\frac{d_o\left(n_i\right)}{N-1} \tag{4}$$

X_{ij} takes the value of $\{0,1\}$, 1 means that node i recognizes a relationship with node j, and N is the total number of nodes in the network. The inward node centrality is the sum of the number of other nodes admitting to have a relationship to a node, and the formula is expressed as:

$$C_{DI}\left(n_i\right)=d_i\left(n_i\right)=\sum_{j=1} X_{ji} \tag{5}$$

The standardized formula is:

$$C_{DI}'\left(n_i\right)=\frac{d_I\left(n_i\right)}{N-1} \tag{6}$$

X_{ji} takes the value $\{0,1\}$, 1 indicates that node j recognizes a relationship with node i, and

N is the total number of nodes in the network.

The microblogging community network can be abstracted into the directed graph case discussed above, where nodes denote microblogging users, and the pointing between nodes denotes whether or not there is interactive behavior between nodes. A node with more in-direction indicates that it is followed to a large extent and the information it posts should be more important and useful, so the importance of a node can be measured by the in-direction of the node. If the inward point degree centrality of a node is high, it means that the node is a core node in the network as a large number of users are following that user. Thus the inward pointwise centrality of a node can be used to evaluate the importance of a user in the community.

2.3.2. Degree of intermediary centrality

The mediator centrality metric measures the ability of a node to act as a mediator, that is, a node that occupies a position on the shortest path of two other nodes, which refuses to act as a mediator, and then these two nodes cannot communicate. The more such positions a node occupies, the more it represents that the node is highly intermediary, and the more nodes must pass through it when they interact.

If a node forms a link between two separated components of a network, that node is a cut point, commonly known as a "bridge". The bridge node plays a very important intermediary role in the exchange of information between two separate groups, if the bridge node can intermediate the interaction and information between the two groups, then its intermediary centrality is very high, and through the mastery of the flow of information to obtain intermediary benefits.

The formula for calculating the degree of intermediary centrality is as follows:

$$C_B(n_i) = \sum_{j<k} g_{jk}(n_i) / g_{jk} \tag{7}$$

Standardized formulas (undirected graphs):

$$C_B'(n_i) = \frac{2\sum_{j<k} g_{jk}(n_i) / g_{jk}}{(N-1)(N-2)} \tag{8}$$

Normalized formulas (directed graphs):

$$C_B'(n_j) = \frac{\sum_{jk} g_{jk}(n_i) / g_{jk}}{(N-1)(N-2)} \tag{9}$$

g_{jk} is the number of shortest paths from node j to node k, $g_{jk}(n_i)$ is the number of paths with node i on the shortest path from node j to node k, and N is the total number of nodes in the network. The node mediated centrality takes values between 0 and 1, if 0 means that it cannot control any other node and 1 means that the point can completely control other nodes and is at the center of the network.

In a microblogging network, if user A has commented/retweeted with user B, and user B has commented/retweeted with user C, although user A has not interacted directly with user C, user A and user C may have the possibility to interact through user B. The degree of centrality of a microblogging network node mediator reflects the ability of a node to control the interaction relationships of other nodes.

2.3.3. Proximity to center

Proximity centrality metrics are measured based on the distance between a node and other nodes in the network. The shorter the total distance measured, the higher the proximity centrality of the node, indicating that the node is closely connected to other nodes.

In an undirected network graph, the absolute proximity centrality formula is expressed as:

$$C_c(n_i) = \left[\sum_{j-1}^{N} d(n_i, n_j)\right]^{-1} \tag{10}$$

$d(n_i, n_j)$ represents the distance between nodes i and j. $C_c(n_i)$ is the sum of the distances from

node n_i to all other nodes and then the reciprocal, the larger the value, the smaller the distance between node n_i and all other points and the center of the network. And vice versa.

Normalized formula (undirected graph):

$$C_c'(n_i) = \frac{N-1}{\sum_{j=1}^{N} d(n_i, n_j)} \tag{11}$$

The proximity centrality of this indicator is very demanding, it must be a fully connected graph to calculate, otherwise there will be no distance between some nodes, the more isolated points of the distance weighted value instead of the smaller, the proximity centrality of the value obtained will be very large. For the directed graph requirements are even more stringent, all nodes in the network must be two strong connected to calculate, because these requirements are too strict, and this indicator is highly correlated with the center of the point degree, that is, the center of the point degree of nodes tend to be close to the center of the degree is also high, so this indicator is usually rarely used.

In summary, the point centrality and intermediary centrality of the nodes of the microblogging community network can be used to measure the importance of the user, and a high degree of importance is a core member of the user.

2.4. Social network distance and diameter

2.4.1. Average shortest distance

For an unprivileged graph G, if two disjoint nodes i, j can be connected by a sequence $(i,l_0),(l_0,l_1),\cdots\cdots,(l_{m-2},j)$ containing m edges, and these m edges are not repeated, and the corresponding nodes are not repeated, then these m edges form a path from node i to node j, and m is called the length of the path. In general, there is more than one path between nodes i and j, and the path with the shortest length is called the shortest path, and its length is also called the shortest distance, denoted as d_{ij}. For a power graph, the length of a path is defined as the minimum of the sum of the weights of all the paths.

A concept often used in social network research is called the average shortest distance, denoted as L, and calculated as:

$$L = \frac{1}{\frac{1}{2}N(N-1)^{i>=j}} \sum_{ij} d_i \tag{12}$$

In Equation (12), N is the number of nodes. Formula (12) has a problem that when there are two nodes in the network such as two nodes without path connection, then the topic of the shortest distance between them is defined as ∞, resulting in L cannot be calculated. A more reasonable definition of average shortest path is given in this regard as in Eq. (13).

$$L = \left(\frac{1}{\frac{1}{2}N(N-1)^{i>=j}} \sum_{ij} d^{-1} \right)^{-1} \tag{13}$$

According to Eq. (13), a distance of infinity between two points corresponds to the inverse of the distance being 0, so the average path length is always a finite value. For a message propagation network, if the shortest distance between two nodes is shorter, the message propagates more efficiently between them, therefore, the average shortest distance of the network can reflect the efficiency of message propagation in a network. Theoretically, the smaller the average shortest path, the faster the message spreads.

In a friend relationship network, the average shortest distance of the network indicates the average number of friends in the shortest relationship chain between two people within the network. Despite the huge number of nodes in many social networks, the average shortest distance of the network is very small, which is also known as the small world phenomenon.

2.4.2. Network diameter

Given a graph G, G is a connected graph if there exists a path between any two nodes making them connected. For a connected graph, the diameter (D) of the graph is defined as the largest of all shortest paths, Eq:

$$D = \max_{i,j} d_{ij} \tag{14}$$

The diameter of a graph describes the size of the graph in some way; in the case of an information dissemination network, for example, if the average shortest distance of the network is 4.5, this means that a message has to be disseminated 4.5 times on average before it reaches everyone; a network diameter of 6 means that a particular message may be disseminated from one person to another up to 6 times. As can be seen in the introduction to the small-world phenomenon in section 2.4, the vast majority of social networks conform to the small-world phenomenon, which means that the vast majority of social networks have a diameter of no more than 6.

3. Social Network Analysis of College English Classroom in Mixed Mode

3.1. Social network analysis

3.1.1. Overall network visualization

Interaction commentators and initiators were extracted from the attachment of the interaction data sheet in the online classroom of a college English course for a freshman class in a university, saved in a CSV file, and imported into UCINET social network analysis software to form edges, and some of the interaction data are shown in Table 1 below.

Table 1. Partial interactive data

Id	Source	Target	Type	Weight
1	24-24	1-1	Directed	1.0
2	35-35	1-1	Directed	1.0
3	2-2	1-1	Directed	1.0
4	9-9	1-1	Directed	1.0
5	5-5	1-1	Directed	1.0
6	20-20	1-1	Directed	1.0
7	33-33	1-1	Directed	1.0
8	1-1	1-1	Directed	1.0
9	32-32	1-1	Directed	1.0
10	14-14	1-1	Directed	1.0
11	31-31	1-1	Directed	1.0
12	9-9	1-1	Directed	1.0
13	13-14	1-1	Directed	1.0
14	4-4	1-1	Directed	1.0
15	1-1	12-12	Directed	1.0
16	34-34	1-1	Directed	1.0
17	27-28	1-1	Directed	1.0
18	11-11	1-1	Directed	1.0
19	13-13	1-1	Directed	1.0
20	37-37	1-1	Directed	1.0
21	39-39	1-1	Directed	1.0
22	42-43	1-1	Directed	1.0
23	48-48	1-1	Directed	1.0
24	23-23	1-1	Directed	1.0
25	38-38	8-8	Directed	1.0
26	10-10	1-1	Directed	1.0
27	17-17	1-1	Directed	1.0
28	23-23	1-1	Directed	1.0
29	20-20	1-1	Directed	1.0
30	15-15	1-1	Directed	1.0
31	13-13	1-1	Directed	1.0
32	36-36	1-1	Directed	1.0
33	31-31	1-1	Directed	1.0
34	43-43	1-1	Directed	1.0
35	40-41	1-1	Directed	1.0
36	8-8	1-1	Directed	1.0
37	34-34	19-19	Directed	1.0
38	7-7	1-1	Directed	1.0
39	22-22	1-1	Directed	1.0
40	39-39	1-1	Directed	1.0

Number the course participants, with the instructor as number 1 and the students as numbers 2 through 48, and label the nodes with their respective numbers.

3.1.2. Centrality analysis

The degree of the center degree of the points in the discussion forums and WeChat groups of university English courses indicates the sum of outgoing and returning messages that are effectively communicated with the students. Because the network is a directed network, the degree is divided into out-degree and in-degree. The out-degree of a point indicates the number of questions answered by learners in discussion forums and WeChat groups. The in-degree of a point indicates the number of question requests sent by learners in the discussion forums and WeChat groups. Through the analysis of UCINET software, the out-degree, in-degree, and the center degree of the degree of the point of each node can be calculated as shown in Table 2 below.

Table 2. Degree of a point center degree

Id	Penetration	Continuous output	Degree
1	874	374	1248
7	520	208	728
24	386	89	475
8	354	102	456
2	94	321	415
3	351	58	409
20	275	133	408
4	274	104	378
12	127	126	253
28	122	131	253
25	125	126	251
14	109	140	249
23	84	165	249
18	136	105	241
33	103	125	228
27	94	130	224
40	125	89	214
13	104	106	210
16	56	150	206
26	107	93	200
30	85	111	196
11	139	56	195
29	88	104	192
35	98	93	191
22	80	106	186
10	139	43	182
17	90	92	182
9	115	64	179
34	76	100	176
15	111	54	165
19	75	89	164
31	63	95	158
38	78	74	152
39	89	52	141
6	66	64	130
37	69	56	125
5	96	23	119
36	53	56	109
21	59	39	98
32	24	56	80

As can be seen from Table 2, the top number of interactions in the course discussion forum are: teacher 1, students 7, 24, 8, 2, 3, and 20, with the number of interactions reaching more than 400, and teacher 1 reaching more than 1,000. Those with higher in, i.e., higher response to the topic, are Teacher

1, Students 7, 24, 8, 3, 20, 4, etc. Higher out, i.e., more active interactions, were made by 7, 2, 20, 23, 16. The hybrid course had a high frequency of interactions, with 95% of interactions reaching 100 or more, and the lowest number of interactions reaching 80. It acts as a medium and a bridge among the course discussion forums. By analyzing the UCINET software, the mediator centrality of each student's point can be calculated as shown in Table 3.

Table 3. Intermediate centrality of a point

Id	Betweenness Centrality
1	401.38238
7	219.00532
24	210.66882
8	196.99325
3	184.31547
20	181.46954
4	168.21428
11	162.73313
10	157.13641
18	94.93582
12	81.35117
25	78.57708
40	70.27664
28	49.47536
9	48.26011
15	43.97415
14	40.43271
26	25.59468
13	25.42991
33	24.93528
35	1.27620
5	1.21689
2	1.21028
27	1.20736
17	1.20519
39	1.19981
29	1.19302
30	1.18095
23	1.10780
22	1.09033
38	1.07722
34	1.06961
19	0.98912
37	0.91278
6	0.89433
31	0.87430
21	0.84687
16	0.84441
36	0.84170
32	0.83944

Through the “average degree” operation of UCINET, the overall average degree of the interaction network of learners of university English courses was calculated to be 62.16, of which the average degree of discussion forums was 13.18, and the average degree of WeChat groups was 48.98. This shows that the number of messages sent and replied to per capita in the overall online interactions of university English is relatively high, and the interactions are more frequent, but the average degree of discussion forums is much lower than that of WeChat. more frequently, but the average degree of discussion forums is much lower than that of WeChat, reflecting that the previous expectation of relying on course discussion forums for good interaction is far from enough, and that more convenient mobile communication software should be better utilized for interaction activities.

3.2. Centrality analysis

3.2.1. Proximity to centrality

The proximity centrality of a point measures the extent to which an actor is not under the control of other actors, if the distance between an actor and all other actors is short, the greater the value of the proximity centrality of the actor is at the core of the network, and is not under the control of the other actors in the process of information transfer. In a directed graph, inFarness represents the sum of distances at which an actor receives information posted by other actors in a network; outFarness represents the sum of distances at which information posted by an actor reaches other actors; inCloseness represents inner proximity; and outCloseness represents outer proximity. In UCINET, the proximity centrality analysis is performed along Network→Centrality→Closeness and the results are shown in Table 4.

Table 4. Data graph of proximity centrality in college English online teaching

Id	inFarness	outFarness	inCloseness	outCloseness
1	49.000	461.000	103.993	10.908
20	80.000	484.000	69.758	10.495
2	81.000	490.000	68.465	10.572
14	84.000	504.000	67.906	10.156
7	82.000	475.000	66.437	10.759
3	86.000	477.000	66.413	10.292
12	90.000	497.000	61.316	10.797
4	91.000	497.000	60.189	10.336
24	93.000	470.000	59.310	10.003
25	99.000	514.000	58.939	10.084
28	103.000	504.000	58.621	10.304
8	103.000	510.000	58.537	10.036
40	104.000	470.000	56.963	10.575
18	106.000	492.000	54.067	10.674
33	108.000	470.000	51.744	10.935
27	111.000	495.000	50.975	10.757
13	112.000	485.000	50.803	10.573
23	114.000	485.000	49.18	10.534
16	114.000	517.000	47.804	10.611
10	115.000	481.000	46.599	9.965
11	119.000	490.000	44.458	10.243
35	119.000	517.000	42.024	10.985
29	120.000	489.000	41.524	10.879
30	124.000	496.000	40.350	10.834
22	125.000	487.000	38.584	10.157
19	129.000	486.000	35.989	10.519
17	130.000	505.000	34.455	10.201
26	131.000	501.000	33.621	10.805
34	135.000	491.000	32.868	9.985
21	154.000	476.000	32.075	10.487
9	198.000	506.000	31.206	10.426
31	235.000	502.000	30.724	10.161
38	444.000	493.000	29.486	10.104
39	748.000	508.000	28.707	10.227
32	1050.000	483.000	11.986	10.612
37	1163.000	510.000	7.399	10.172
6	1577.000	488.000	3.033	10.642
36	1880.000	501.000	2.387	10.249
15	2187.000	500.000	1.984	10.279
5	2198.000	504.000	1.885	9.875

Table 4 shows that Teacher 1 has a high degree of proximity to the center with a short distance from all other members in the process of obtaining and posting information, indicating that the teacher is at the core of the online classroom and is less likely to be controlled by others in the process of

information transfer.

Students 20, 2, 14, 7, 3, 12, and 4 have a high degree of proximity to the center, are more central in the online classroom, and are less dependent on others in the information transfer process.

3.2.2. Feature vector centrality

The purpose of feature vector centrality is to find the most central member of the network in the sense of the overall structure of the network. In the middle along the bow, the feature vector centrality analysis is carried out and the results are shown in Table 5.

Table 5. Eigenvector centrality data of network classroom

Id	Eigenvec	nEigenvec
1	0.671	89.372
14	0.356	24.364
18	0.285	23.479
3	0.230	22.362
12	0.196	22.031
20	0.185	21.986
7	0.162	21.059
4	0.141	20.494
24	0.136	19.930
33	0.135	18.645
28	0.126	17.975
23	0.123	16.456
40	0.115	16.292
2	0.113	15.636
25	0.099	15.527
8	0.096	14.370
13	0.095	13.062
27	0.092	12.493
21	0.088	11.384
22	0.084	11.006
19	0.084	10.880
11	0.083	10.734
30	0.077	10.483
10	0.076	10.213
35	0.075	10.021
29	0.075	9.865
17	0.066	9.797
5	0.065	9.433
16	0.061	9.419
9	0.058	8.739
31	0.056	8.520
34	0.047	8.437
6	0.036	8.025
39	0.035	7.611
32	0.034	7.306
26	0.033	7.163
38	0.032	6.844
36	0.029	6.439
15	0.020	6.303
37	0.018	6.172

As can be seen from Table 5, Teacher 1 has the highest eigenvector centrality value of 0.671 and is the most central member of the online classroom. Students 14, 18, 3, 12, 20, 7, 4, 24, 33, 28 and other members also have high eigenvector centrality values and are more central members of the online classroom. Members such as students 26, 38, 36, 15, and 37 have relatively low eigenvector centrality values and are the fringe members of the online classroom.

The eigenvector centrality is to find the most central members in the sense of the overall structure of the network, and the analysis results are similar to the results of this study on the point centrality,

intermediate centrality and near centrality that is to say that generally the members with high point centrality, intermediate centrality and near centrality their eigenvector centrality values are also higher.

3.3. Analysis of the internal substructure of social networks

3.3.1. Factional analysis

Cohesive subgroups is not a term used in a conceptual sense in social network analysis; it generally represents the conditions under which positive, close, and direct interaction behavior is achieved between participants in a set. Factions, i.e., two participants connected in a way that is direct and reciprocal in their relationship, so that they constitute a factional subgroup.

Faction analysis is a sub-analysis of the reciprocity of interactions and examines the interaction between members. In UCINET software, a cohesive subgroup analysis of network synchronous classrooms was performed by following the path: network → subgroups → factions, taking the minimum number of members to be three. The faction number and faction members were organized to get Table 6. 50 factions exist in this social network.

Table 6. Network synchronization teaching faction membership distribution

Faction number	Member	Membership	Faction number	Member	Membership
1	1 7 29	3	26	1 28 37	3
2	1 2 4 5	4	27	1 5 21	3
3	1 20 22	3	28	1 16 30	3
4	1 14 30	3	29	1 14 25	3
5	1 7 28	3	30	1 12 22	3
6	1 3 4 24	4	31	1 2 27	3
7	1 12 17	3	32	1 28 33	3
8	1 8 36	3	33	12 16 19	3
9	1 25 21	3	34	15 24 35 39	4
10	1 2 27	3	35	4 9 14	3
11	1 28 29	3	36	6 16 20	3
12	1 4 7 8	4	37	9 11 32	3
13	1 3 25 30	4	38	13 18 19	3
14	1 25 33	3	39	22 31 34	3
15	1 24 28 38	4	40	11 35 40	3
16	1 3 26	3	41	2 22 37	3
17	1 8 11	3	42	3 14 31	3
18	1 12 23	3	43	16 25 28	3
19	1 4 10 19	4	44	3 8 24	3
20	1 32 38	3	45	28 29 32	3
21	1 7 9 35	4	46	7 24 31	3
22	1 20 22 28	4	47	10 12 34	3
23	1 5 20	3	48	8 14 23	3
24	1 10 19	3	49	4 16 39	3
25	1 22 29	3	50	25 27 30	3

From Table 6, it can be learned that Teacher 1 and Students 22, 25, 28 appear many times in different subgroups, indicating that these three have more frequent interactions with other actors and are the core actors in the network synchronous classroom. The fact that some members appear in different factions leads to the fact that there will be overlapping members in each faction, and the analysis of faction overlap shows that students 22, 25, and 28 appear the most times in different factions, and are the core actors in the network synchronous classroom of college English. Members 3, 4, 7, 8, 12, 14, 16, 24, who are also more active in the student group, participated in the discussion and communication. Members 9, 10, 21, 23, 33, 34, 37, 38, 39 maintained interaction with only a few members. Members 6, 13, 15, 17, 18, 26, 36, and 40 were only present in 1 subgroup, indicating that they participated in classroom interactions less frequently.

3.3.2. Block Model Analysis

The results of subgroup distribution of university English network synchronous classroom can be

obtained by following: network → role/position → structure → CONCOR in UCINET. There are six subgroups in this network structure, and the density analysis of these six subgroups can get the subgroup distribution. According to the results of subgroup analysis, it can be obtained that there are six subgroups in this network, and the subgroups are correlated with the actual grouping, but they are not exactly the same. The membership distribution of the subgroups is shown in Table 7.

Table 7. The subgroup membership distribution of network synchronous teaching

Subgroup number	Member distribution
1	1
2	22, 25, 28
3	3, 4, 7, 8, 12, 14, 16, 24
4	2, 5, 11, 19, 20, 27, 29, 30, 32, 32, 35,
5	9, 10, 21, 23, 33, 34, 37, 38, 39
6	6, 13, 15, 17, 18, 26, 36, 40

3.3.3. Core degree analysis

The analysis of the core-edge model of the university English online synchronous classroom shows that there are 15 core members in the university English online synchronous classroom, and the other members are in the edge position. The density between the core members is 0.200, the density between the edge members is 0.075, and the density value on the non-diagonal line is not analyzed. During the analysis, UCINET simultaneously gives the core degree of each member as in Table 8.

Table 8. The core degrees of network synchronization class members

Id	Core degree	Id	Core degree
1	0.682	11	0.090
28	0.219	35	0.089
22	0.208	29	0.089
25	0.201	30	0.082
7	0.198	5	0.082
3	0.191	19	0.078
12	0.186	32	0.077
4	0.176	38	0.074
24	0.170	34	0.073
14	0.162	21	0.071
20	0.157	9	0.070
8	0.132	31	0.068
2	0.119	26	0.067
39	0.104	18	0.063
33	0.100	17	0.063
27	0.097	13	0.061
37	0.094	6	0.060
23	0.094	36	0.058
16	0.093	15	0.053
10	0.092	40	0.044

According to Table 8, the top three core degree numbers are Teacher 1, Student 28, and Student 22, who are the core members of the synchronous online classroom. Members numbered 25, 7, 3, 12, 4, 24, 14, 20, 8, 2, 39, and 33 have core degree number more than 0.1 and are core members. Students 27, 37, 23, 16, 10, 11, 35, 29, 30, 5, 19, 32, 38, 34, and 21 have a core degree number in the medium range and are semi-marginal characters in the synchronous online classroom. The other members have low core degree values and are borderline characters in synchronous online classrooms.

4. Conclusion

In this paper, we conduct an innovative research on college English classroom by integrating the hybrid model and launch a social network analysis with the online classroom of college English course in the freshman class of a university. The results are as follows.

(1) The overall average degree of the interaction network of learners of the college English course in this class is 62.16. Among them, the average degree of the discussion forum is 13.18, and the

average degree of the WeChat group is 48.98.

(2) Teacher 1's inFarness in the process of acquiring and posting information is only 49.000, which is a short distance from all other members, indicating that the teacher is in the core position in the online classroom.

(3) The core degree of Teacher 1 is 0.682, and the core degrees of the top students 28, 22, and 25 are 0.219, 0.208, and 0.201, respectively, which are the core figures in the synchronous network classroom of college English.

The innovation of college English teaching in hybrid mode proposed in this paper is effective, students actively participate in it, and it is conducive to stimulating students' interest and motivation in English learning.

References

1. Wang, L. (2021). Construction of college english blended teaching model: an outcome-based education approach. Open Access Library Journal, 8(9), 1-16.
2. Albiladi, W. S., & Alshareef, K. K. (2019). Blended learning in English teaching and learning: A review of the current literature. Journal of Language Teaching and Research, 10(2), 232-238.
3. Zhou, C. (2018). Empirical study on the effectiveness of teaching model of college English writing within blended learning mode. Kuram ve Uygulamada Egitim Bilimleri, 18(5), 1060-1076.
4. YAN, H. C., SONG, Y. Q., & HAN, Y. Y. (2024). An Analysis on the Blended Teaching Mode of College English. Sino-US English Teaching, 21(1), 1-5.
5. Sun, Z., & Qiu, X. (2017). Developing a blended learning model in an EFL class. International Journal of Continuing Engineering Education and Life Long Learning, 27(1-2), 4-21.
6. Feng, H. (2024). A Blended Teaching Model of College English Based on Deep Learning. Journal of Electrical Systems, 20(6s), 1505-1515.
7. Cheng, J. (2022). Research on blended teaching strategies of college English translation based on computer corpus. Wireless Communications and Mobile Computing, 2022(1), 8631464.
8. Jiang, M., & Wu, X. (2022). Exploration and practice of college english multi-blended teaching model based on OBE concept. Open Journal of Modern Linguistics, 12(4), 367-379.
9. Wang, Y. (2020). A study on college English high-efficiency class based on blended teaching mode of flipped classroom. Theory and Practice in Language Studies, 10(9), 1066-1071.
10. Zhu, L. (2019). A research on the reform of college English blended teaching mode under the background of educational informatization. In ITM Web of Conferences (Vol. 26, p. 01011). EDP Sciences.
11. Li, G. (2017, April). A study on the blended-teaching mode combining MOOCs and flipping classroom in college English teaching. In 7th International Conference on Education, Management, Information and Mechanical Engineering (EMIM 2017) (pp. 1268-1274). Atlantis Press.
12. Tan, X. (2019). On reform of college English teaching based on the FiF smart learning platform. Journal of language teaching and research, 10(5), 1067-1072.
13. Wang, R. (2019). Massive Open Online Course Platform Blended English Teaching Method Based on Model-View-Controller Framework. International Journal of Emerging Technologies in Learning, 14(16).
14. Wu, C. (2022). Effect of online and offline blended teaching of college English based on data mining algorithm. Journal of information & knowledge management, 21(Supp02), 2240023.
15. Guan, A. (2021). Research on blended teaching model in college English based on mobile learning app. Journal of Contemporary Educational Research, 5(1).
16. Xie, Q., & Tsai, S. B. (2021). An empirical study on innovation of college blended teaching under big data analysis. Mathematical Problems in Engineering, 2021(1), 3752037.
17. Yin, W. (2020). The application and research of College English blended Teaching Mode based on MosoTeach. Journal of Contemporary Educational Research, 4(9).