



Research on Knowledge Dissemination of Short Video Platforms from the Perspective of Social Network Analysis—Take Bilibili as an Example

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Abstract. In the era of short videos, Bilibili has become an important platform for young people to acquire knowledge. Based on the perspective of social network analysis, the follow network of Bilibili knowledge domain creators are constructed, and the structural characteristics of Bilibili knowledge dissemination network are explored by using Ucinet software, concluding that the knowledge dissemination relationships of Bilibili creators are scattered, the dissemination power varies significantly, and the knowledge content of Bilibili covers a wide but uneven area, and proposed optimization strategies for Bilibili knowledge dissemination.

Keywords: social network analysis · Bilibili · knowledge dissemination · short videos

1 Introduction

In the era of short videos, short videos are deeply involved in public life, and the theme has gradually shifted from entertainment content to pan-knowledge content, opening up a new field of knowledge production and dissemination. At present, pan-knowledge content accounted for 45% of the total video views of Bilibili, and in the past year, the scale of creators in the knowledge district has increased by 92%, and about 183 million people were studying at Bilibili, [1] the user scale of the knowledge area of Bilibili, the size of the video creators' fan base and the quality of their works showed the vitality of Bilibili's knowledge content, and Bilibili had also become a mainstream platform for knowledge short videos and one of the main positions of knowledge dissemination. Therefore, the analysis of the structural characteristics of the social network of knowledge dissemination of Bilibili was conducive to promoting the construction of knowledge area of Bilibili and the improvement of knowledge dissemination level.

2 Literature Review

With its short form, rich audio-visual, entertaining and knowledge-intensive features, knowledge short videos have constantly broken through the boundary of knowledge dissemination, created a new channel for knowledge dissemination and created a new

context for social education and cultural dissemination. In recent years, a series of researches have been conducted in the academic field on knowledge dissemination in the short video era. Li Miao and Wei Wenxiu believed that knowledge-based short videos have the function of integrating social relations and extending social networks, and promote society to enter a new stage of knowledge inclusion [2]. Gu Huimin and Xu Yunqi analyzed the reasons for the “popularity” of short-video knowledge dissemination and existing problems, and propose corrective measures in order to provide references for enhancing the effect of short-video knowledge dissemination [3]. Gao Guiwu and Ge Yi analyzed the knowledge-based short videos of Bilibili from the perspective of college theory and suggest that only by resolving the conflict between the youth discourse system and the mainstream knowledge communication context can their development be stable and far-reaching [4]. In summary, the current academic community has mostly studied knowledge dissemination in the short video era from the perspectives of content production, dissemination strategies and dissemination effects, ignoring the role of the network structure among knowledge video accounts. Social network analysis is a set of norms and methods to analyze the structure of social network relationships and their attributes. Through social network analysis, the connection relationship and network structure characteristics among individuals can be accurately quantified. The knowledge zone is a field specially established by Bilibili for knowledge dissemination, and the content creators of the knowledge zone are the representative group of knowledge dissemination. Therefore, this paper will creatively introduce the social network analysis method, take the knowledge zone content creators as the research object from a micro perspective, analyze the network structure characteristics of knowledge dissemination of Bilibili knowledge zone content creators by using Ucinet software, and explore the path to improve the knowledge dissemination level of Bilibili.

3 Study Design

3.1 Data Source

The data analysis platform “New Station” provides the ranking list of knowledge content creators of Bilibili, which counts the number of fans, fan increments, plays, pop-ups, coins and favorites of knowledge content creators, and calculates the scores and ranks them according to the fixed algorithm rules. In this paper, we selected the top 150 content creators in the comprehensive ranking of knowledge area knowledge content creators (the data are counted from Nov. 1 to Dec. 31, 2022), and obtained the follow lists of these 150 knowledge content creators with the help of Python. In the data processing stage, it was found that 54 knowledge content creators had set privacy permissions and their follow lists were invisible.

3.2 Data Processing

In this paper, we took 96 knowledge video creators as the research objects, and took their following and being followed relationship as the starting point, constructed a 96*96 binary directed matrix, and imported it into Ucinet software to draw the knowledge

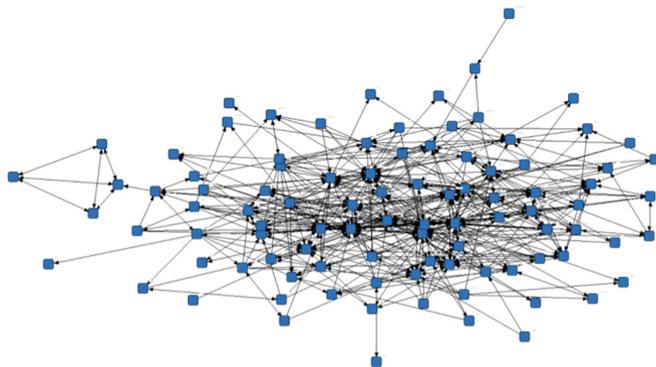


Fig. 1. Knowledge dissemination matrix of Knowledge video creators of Bilibili

dissemination network relationship diagram of video creators of Bilibili, each node in the diagram represented different knowledge video creators, and the directed arrows between nodes indicated the following relationship between knowledge video creators. According to Fig. 1, 96 nodes are in a tightly connected network.

In this paper, we first measured the overall characteristics of the knowledge dissemination network of Bilibili using network density analysis and small-world network analysis, and then explored the status characteristics of individual knowledge video creators in the knowledge dissemination network of Bilibili using centrality indicators to find the rules of knowledge information flow in this network, with a view to creating a benign knowledge dissemination field.

4 Data Analysis

4.1 Structural Analysis of the Overall Bilibili Knowledge Dissemination Network

With the help of two means, network density analysis and small-world network analysis, we can measure the structural characteristics of the whole Bilibili knowledge dissemination network, so as to evaluate the transmission and interaction behaviors of knowledge information in the network.

Overall Network Density: Discrete Knowledge Dissemination Relationships

Network density reflects the degree of interaction between different nodes in a social network and is a key indicator to measure the closeness of each node, and its measurement

Table 1. Indicators of knowledge dissemination network structure of Bilibili

Density	Number of Connections	Average Length of Path (L)	clustering Coefficient(C)
0.0589	537	3.109	0.228

value is between 0 and 1. The closer to 1 represents the closer the degree of connection, and the opposite represents the looser the degree of connection [5]. The clustering coefficient is a measure of the cohesiveness of the network and is proportional to the cohesive strength of the overall network [6]. As can be seen from Table 1, the network density of 96 knowledge video creators is 0.0589, the number of network connections is 537, the clustering coefficient is 0.228, and the average path distance is 3.109, indicating that most of the creators have difficulty in exchanging knowledge information with more than three users, the group is loosely connected, the degree of information sharing is low, and the influence of knowledge information can hardly be effectively exerted.

Overall Network Cohesiveness: Small-World Effect Is Significant

Small-world network refers to a social network in which most of the nodes are not directly related, but can be connected through a few core nodes, and the small-world phenomenon is measured mainly with the help of “clustering coefficient value C” and “path length mean L”. If the ratio of the clustering coefficient C of the overall network and its random network is greater than the ratio of the average path length L of both, the overall network can be considered to have a small-world effect [7].

Firstly, a random network with 96 nodes is constructed in Ucinet software, and the average path length of the network $L(\text{random network}) = 3.971$ and the clustering coefficient $C(\text{random network}) = 0.031$ are calculated separately. From Table 1, we can see that $L(\text{Bilibili knowledge dissemination network}) = 3.109$ and $C(\text{Bilibili knowledge dissemination network}) = 0.228$, and the calculation can be obtained that $C(\text{Bilibili knowledge dissemination network})/C(\text{random network}) > L(\text{Bilibili knowledge dissemination network})/L(\text{random network})$, so it can be considered that there is a “small-world effect” in the follow relationship network of creators in the knowledge area of Bilibili. This indicated that in the follow relationship network of creators in the knowledge area of Bilibili, the transmission of knowledge information was concentrated within individual small groups, with a high degree of central aggregation and a high degree of peripheral dispersion, and the overall network knowledge information circulation was not smooth, and users located at the edge of the network obtained knowledge information slowly, and most creators needed to contact other creators through other nodes, which to a certain extent affected the efficiency of knowledge information transmission.

4.2 Centrality Analysis

The analysis of network centrality helps us understand the position, role and power distribution characteristics of individual video creator in the network of the knowledge area of Bilibili. The core thinking of social network analysis is to consider power as a relationship, and the less the nodes are restricted, the better the network position. Network-mediated power arises from the aggregation effect formed by the interaction of subjects. Individuals with strong centrality have a high degree of identification, while those with weak centrality are infected and assimilated, thus creating network-mediated power [8]. The network centrality is analyzed by considering two main metric: point centrality and intermediate centrality [9].

Point Degree Centrality Analysis: Core Creators in the Knowledge Dissemination Network of Bilibili

The point degree centrality of a node is the number of other nodes directly connected to the node. If the node is directly connected to multiple nodes, it has a high point degree centrality. The higher the point degree centrality of a node, the higher the degree of centrality of the node and the higher the influence. Since the follow relationship among knowledge-based video creators in this paper is directional, the analysis of point centrality contains two aspects, point-out degree and point-in degree analysis, where point-out degree indicates that one creator follows other creators and point-in degree indicates that one creator is followed by other creators.

As can be seen from Table 2, the three knowledge video creators, “Luo Xiang Says Criminal Law”, “Infinite Xiaoliang’s Science Daily” and “Hardcore Half Buddha Immortal”, have the highest entry degree, all above 20. This indicates that they have the highest degree of follow and greater voice in the social network. The point centrality potential measures the structural trend of the overall social network. If there is a huge difference in point degree centrality in a social network, it indicates that the network has an obvious centripetal trend and there are key nodes that interact and communicate relatively closely with other nodes. The point-out degree centrality index of this network is 25.961%, and the point-in degree centrality index is 31.280%, both of which are low, and 74 creators have a point-in degree less than 10, 81 creators have a point-out degree less than 10, and some creators have a point-in degree or a point-out degree of 0. This indicates that at present, the core members of creators in the knowledge area of Bilibili are relatively few, the types of creators in the knowledge area of Bilibili are diversified, the objects of follow are relatively. The overall integration degree of the network is poor. However, the latter value is higher than the former, which also shows that key opinion leaders such as “Luo Xiang Says Criminal Law”, “Hardcore Half Buddha Immortal” and “Infinite Xiaoliang’s Science Daily” play a great role in strengthening and guiding users’ communication and interaction.

5 Intermediate Centrality Analysis: Intermediary Creators in the Knowledge Dissemination Network of Bilibili

Intermediate centrality reflects the number of times a node acts as the shortest bridge intermediary node, which is a measure of control ability. The higher the value, the stronger the node has the ability to publish information and control topics in the network. As can be seen from Table 2, in the social network formed by the creators of the knowledge area of Bilibili, “Luo Xiang Says Criminal Law”, “oooooooohmygosh”, “Hardcore Half Buddha Immortal”, “Infinite Xiaoliang’s Science Daily” and “English Rabbit” have higher intermediate centrality. This indicates that in this knowledge dissemination network, these creators are more active in information dissemination and have certain topic control ability, and play the roles of coordinating the knowledge information transmission of the community. Other creators need to go through these core video creators to achieve the purpose of exchanging information.

In addition, intermediate centrality index of the network is 12.83%, which is at a low level, indicating that the cohesiveness of the knowledge dissemination network of Bilibili is poor, and most of the creators have small network nodes and are at the edge of

Table 2. Point Degree Centrality/Intermediate Centrality of Bilibili Knowledge Video Creators (Top 5)

POINT DEGREE CENTRALITY				INTERMEDIATE CENTRALITY	
KNOWLEDGE-BASED VIDEO CREATORS	Point-in Degree	Knowledge-based Video Creators	Point-out Degree	Knowledge-based Video Creators	Intermediate Centrality
LUO XIANG SAYS CRIMINAL LAW	35	The hardworking Dong Jianing	30	Luo Xiang Says Criminal Law	15.296
INFINITE XIAOLIANG'S SCIENCE DAILY	29	DongDongGun	23	ooooohmygosh	10.377
HARDCORE HALF BUDDHA IMMORTAL	25	ooooohmygosh	22	Hardcore Half Buddha Immortal	10.279
RABBIT BAGE	19	Summer Hail Channel	19	Infinite Xiaoliang's Science Daily	9.196
THE HARDWORKING DONG JIANING	15	Hardcore Half Buddha Immortal	17	English Rabbit	8.55

the network, so the overall network's diffusion ability is not strong. To a certain extent, this inhibits the diffusion of knowledge information.

Combined the analysis of individual creators who built the knowledge dissemination network of Bilibili, we found that the larger the fan base, the greater the possibility that creators have a higher degree of access and intermediate centrality in the knowledge dissemination network, and the greater the possibility that they hold the "power" of knowledge dissemination. "Luo Xiang Says Criminal Law", "Hardcore Half Buddha Immortal", "Infinite Xiaoliang's Science Daily", "English Rabbit" were all head creators in the knowledge area of Bilibili and were widely concerned by users in the knowledge area of Bilibili.

6 Study Results

By constructing the knowledge dissemination network of 96 Bilibili knowledge area creators and exploring their overall network structure and individual power structure using social network analysis, the following three research results were obtained.

Firstly, from an overall perspective, the knowledge dissemination relationships of video creators in the knowledge area of Bilibili were discrete. The results of the overall network density and small-world effect analysis showed that although, on the surface, the creators in the knowledge area of Bilibili have formed a relatively tightly connected network, the overall network density was only 0.0589, and the overall data of point-in and point-out degrees among the creators were low, and although there was a certain degree of connection among the creators, the network connection relationship was relatively discrete, the interaction was lacking, and the speed of knowledge information dissemination was slow.

Secondly, from an individual perspective, there was a significant difference in the dissemination power of creators in the knowledge area of Bilibili. The central potential index of point-out degree and central potential index of point-in degree of knowledge information dissemination network of creators in the knowledge area of Bilibili showed that there

were fewer core members in the network, and most creators lived in marginal positions, showing a core-edge structure, “Luo Xiang Says Criminal Law”, “Infinite Xiaoliang’s Science Daily” and “Hardcore Half-Buddha Immortal” were among the creators in the core position of the network who held the power of knowledge dissemination.

Thirdly, from the viewpoint of content classification, the knowledge content of Bilibili covered a wide range but developed unevenly, and Bilibili divided knowledge into “science”, “social science, law and psychology”, “humanities and history”, “finance and business”, “campus learning” and other eight sub-divisions, and the distribution of knowledge content was very comprehensive. However, if we look at the video contents released by 96 creators, we found that the creators who released “social science, law and psychology”, “humanities and history” and “science and popularization” were the most popular. The creators of these three areas of content accounted for a larger proportion of the entire network and were mostly in the top positions, especially in the fields of “social science, law and psychology” and “humanities and history”. However, few knowledge creators were involved in the “design-creative” and “wild skills society” subdivisions and were at the bottom of the list. This showed that there was an imbalance in the development of the knowledge area of Bilibili.

7 Optimization Strategies

Firstly, promotes the cooperation and interconnection of knowledge video creators to enhance the propagation power. At present, the information dissemination network structure of creators in the knowledge area of Bilibili was discrete, and it was difficult to form the dissemination synergy. In view of this, Bilibili should not only attract more experts and scholars and high-quality knowledge creators to reside in the area, but also increase the frequency of official knowledge dissemination activities such as “Knowledge Light Year - Bilibili youth science project” to encourage and facilitate the follow and cooperation of knowledge creators.

Secondly, expand the development space of knowledge video creators and improve their influence. Although a large number of experts and professors were currently stationed in Bilibili, most of them did not have a high degree of follow due to the lack of awareness and team to operate and maintain their accounts. Therefore, on the one hand, Bilibili can use the algorithm mechanism to increase the exposure of high-quality knowledge creators and contents, so that more Bilibili users can see them; on the other hand, Bilibili has a “joint submission” mechanism, which is a way to show multiple creative members at the same time, and creators can take the initiative to use this mechanism to seek cooperation with video creators with matching professional background and high number of fans to improve their “presence”.

Finally, optimize the classification management of knowledge video creators and balance the content layout. At present, there was a problem of unbalanced distribution of content layout in the knowledge area of Bilibili. The creators of “social science, law and psychology” and “humanities and history” were mostly present, while the number of creators in other professional fields were small, which easily made users fall into the information cocoon. Therefore, Bilibili should attract or invite institutions or scholars in various professional fields to reside in the area, so as to maintain the thriving

scene of humanities and social science knowledge and promote the blossoming of multidisciplinary knowledge to meet the knowledge needs of various users and realize the heterogeneous and synergistic development of knowledge area content.

This paper took the creators of knowledge videos on Bilibili as an example and developed a social network analysis of them, which to a certain extent provided ideas for how to promote the development of knowledge dissemination in the short videos era. However, due to the privacy authority of creators, this paper suffered from certain interference in selecting samples. Therefore, the data will be further improved in the future, so as to provide references for how to better knowledge dissemination.

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