

# Application of Danmaku Technology in Teaching Visual Analysis Based on Citespace

Han Ziyi

*School of Information Science and Technology, Yunnan Normal University, Kunming, Yunnan, 650500, China*

**Abstract:** *This study used bibliometric analysis and CiteSpace software to visually analyze 187 relevant literature on the application of Danmaku technology in teaching in the CNKI database from 2015 to 2023. Research has found that in terms of content, research in this field mainly focuses on "Rain Classroom", "classroom teaching", "teaching mode", and "online learning". The hot topic is gradually shifting from classroom teaching in formal learning to online teaching and informal online learning. Researchers are enthusiastic about discussing the use of Danmaku technology platforms to integrate Danmaku technology into the interaction between classroom teaching and online learning, creating real-time communication scenarios for learners, and thus stimulating their learning interest.*

**Keywords:** *Danmaku technology; Online learning; Teaching application; Danmaku Video; Teaching interaction*

## 1. Introduction

Science and technology are advancing rapidly, bringing forth new ideas, and human learning methods have undergone significant changes. In the era of "Internet plus", a new media interaction technology Danmaku provides us with a new way of interaction. The Danmaku was initially popular in Asian countries such as China, Japan, and South Korea, and is a product of cluster behavior, which is the sharing of views between users who watch synchronized or unsynchronized content. <sup>[1]</sup>Due to its short and casual content, as well as its ability to interact in real-time, it is highly sought after and loved by young people. After being introduced into the field of education and teaching, scholars have found that its real-time interactivity strengthens the interaction between learners in discussions, debates, and other aspects of the learning content itself, improves the visual and presence sense of learner participation<sup>[2]</sup>, and can enhance the understanding of the learning content. What new forms of application of Danmaku in education and teaching have attracted the author's interest. Starting from this, this study uses CiteSpace to visually analyze relevant literature on the application of Danmaku technology in teaching in China. It conducts in-depth analysis from multiple dimensions such as publication time, author, institution, and research hotspots, in order to enhance the practical application of Danmaku technology in the field of education and promote further development in this field.

## 2. Research Design

### 2.1. Method and Instruments

The author mainly adopts visual analysis method and selects CiteSpace as a bibliometric tool to conduct in-depth analysis from keyword co-occurrence graph and keyword time zone clustering graph, exploring the research hotspots and development trends of Danmaku technology in teaching applications in China.

### 2.2. Data sources

The literature data retrieval source for this study is the CNKI Infrastructure database. The search period is set to be from January 1, 2015 to December 30, 2023. The literature search method adopts "advanced search", with the search field set to "theme" and the search keywords being "Danmaku technology", "Danmaku teaching application", and "Danmaku learning application". At the same time, articles such as meetings, notices, and reports are excluded, and literature unrelated to this study is

deleted based on reading the literature title, abstract, and keywords. Finally, 187 valid literature were obtained.

### 3. Research hotspots and trend analysis results

#### 3.1. Keyword co-occurrence analysis

Keywords are the core words that summarize the core content of a literature. Keywords with high centrality and frequency represent the common concerns of researchers over a period of time, namely research hotspots. Centrality, as a measure of the power of a node, reflects its importance in the network. The higher the co-occurrence frequency and centrality of keywords, the more important the node is in the field [3]. Therefore, the author has summarized the keywords with high frequency and centrality, as shown in Table 1.

Table 1: High frequency keywords and High centrality keywords

	High frequency keywords		High centrality keywords	
	Keywords	Count	Keywords	Centrality
1	Rain Classroom	58	Danmaku	0.70
2	Danmaku	40	Rain Classroom	0.54
3	Classroom Teaching	9	Classroom Teaching	0.15
4	Teaching Model	9	Danmaku Screen Video	0.14
5	Danmaku Screen Video	8	Micro Danmaku	0.13
6	Online Learning	8	Online Learning	0.11
7	Application	7	Application	0.11
8	Teaching Effectiveness	7	Teaching Effectiveness	0.11
9	Teaching Reform	7	Teaching Reform	0.09
10	Micro Danmaku	6	Online education	0.09

From Table 1, it can be seen that in addition to the bullet screen itself, the keywords that appear more frequently in the research literature include "Rain Classroom", "Classroom Teaching", "Teaching Mode", and "Online Learning", among which the sentiment is also higher. However, there is a certain difference in the ranking of the two. These keywords have received a lot of attention in the research field and are hot or important topics of research. And it occupies a core position in the citation relationship, co-occurrence relationship, and other networks of literature, which is of great significance for understanding the structure and dynamics of the entire research field. Specifically, "Rain Classroom" as a keyword, its high frequency and high school mentality reflect its core role in the application of Danmaku teaching. As a teaching platform, Rain Classroom's bullet screen function provides teachers and students with a real-time platform for interaction and exchange of ideas, thereby enhancing classroom activity and student participation. Therefore, in the application research of Danmaku teaching, "Rain Classroom" is frequently mentioned and has become an important focus of research. "Classroom teaching" and "online learning" are important scenarios for the application of Danmaku teaching, providing a rich practical environment and display stage for the application of Danmaku technology. Therefore, how to apply Danmaku in these two scenarios has become a research focus and focus. In the future, with the continuous progress of technology and the deepening of research, we have reason to believe that the application of Danmaku teaching will play a more important role in the field of education.

#### 3.2. Keyword cluster analysis

By utilizing the cluster function of CiteSpace, keywords can be roughly grouped into 9 categories (as shown in Figure 1). For ease of viewing, the "timeline" function is used to arrange them and generate a keyword time zone cluster map, which can clearly show the focus of researchers at different time periods.

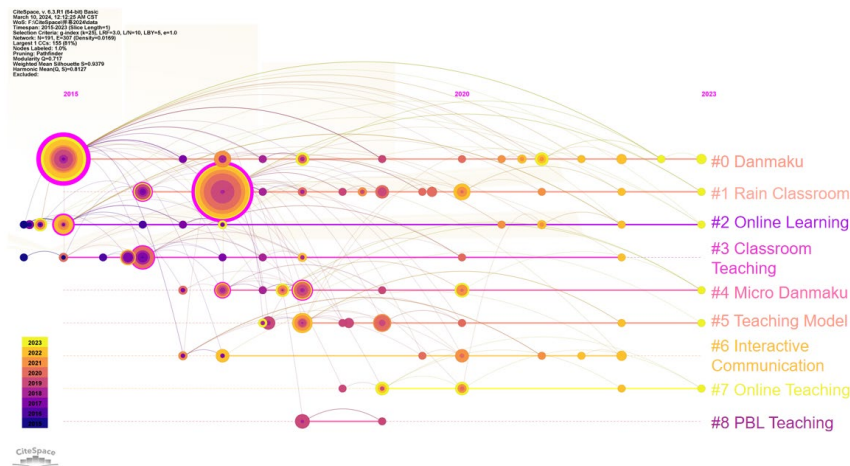


Figure 1: Keyword Time Zone Cluster Graph

### 3.2.1. Cluster0 & Cluster4 (Danmaku & Micro Danmaku)

These three clusters mainly reflect the different manifestations of Danmaku applied in the field of teaching today. Specifically, research hotspots mainly focus on the following three learning scenarios: one is in the traditional collective teaching scenario, which combines intelligent teaching with Danmaku functional technology platforms such as Rain Classroom in classroom teaching, fully utilizing the characteristics of Danmaku to enhance classroom interactivity and improve student learning participation; The second is in online learning scenarios, using Danmaku to enhance communication and interaction between teachers, students, and students, in order to eliminate the drawbacks of time and space separation; The third is the self-directed learning scenario in informal learning scenarios. Danmaku provides the possibility for asynchronous learning communication, increasing communication and interaction among learners, and improving their learning participation [2].

### 3.2.2. Cluster1 (Rain Classroom)

Since its official launch in 2016, Rain Classroom has utilized its powerful Danmaku feature to transplant the popular Danmaku feature from video websites to the classroom environment [4]. Due to the platform's ability to simultaneously display multiple Danmaku messages sent by students on the screen, unlike traditional classroom student presentations, the introduction of Danmaku enables collective discussion among all students[5]. So once the platform was launched, it was favored by researchers, and teachers from various disciplines used it as a teaching tool, attempting to integrate it with specific subject courses. Therefore, the research hotspots under this cluster focus on Danmaku's application in improving teaching methods, innovating teaching models, and real-life classrooms.

### 3.2.3. Cluster 2, Cluster 3 and Cluster 7 (Online Learning, Classroom Teaching and Online Teaching)

As the traditional core of educational activities, "classroom teaching" still occupies an important position in the application research of Danmaku teaching. How to introduce the new interactive research focus of Danmaku into classroom teaching has become a research focus of Danmaku teaching application. But with the booming development of online learning on a global scale in recent years, the application scenarios of Danmaku teaching are gradually shifting towards the field of online learning. Online learning and online teaching are often the main scenarios for Danmaku technology education and teaching applications, and research focuses on learning analysis, spatiotemporal interaction, and Danmaku interaction. How to enhance the learning engagement of online learners has always been a hot topic in the education industry. The intervention of Danmaku technology undoubtedly injects new vitality into research in this field, which is of great significance for promoting the development and innovation of online education.

### 3.2.4. Cluster 5 & Cluster 7 (Teaching Model and PBL Teaching)

The teaching mode, as the organizational framework and strategy of educational activities, provides guidance and basis for the implementation of Danmaku teaching. As an emerging teaching method, bullet screen teaching needs to be combined with appropriate teaching modes to fully leverage its advantages. In the application of Danmaku teaching, by introducing different teaching modes, the

interactive and real-time characteristics of Danmaku can be better utilized, improving teaching effectiveness and learning experience. Among them, the PBL model, which is a problem based learning model, has attracted the attention of researchers. The PBL model emphasizes problem centeredness, guiding students to actively explore and solve problems, cultivating their critical thinking, problem-solving skills, and self-learning abilities. In the Danmaku teaching environment, students can use the Danmaku function to ask questions and share opinions in real time, and interact with teachers and other students. This instant and open communication method helps to create a positive learning atmosphere, promoting students' thinking collision and knowledge construction. In addition, the application of Danmaku teaching also provides new possibilities and development space for the PBL model. Through the bullet screen function, teachers can more flexibly organize questions and guide students to discuss, making the PBL mode more vivid, interesting, and efficient.

### 3.2.5. Cluster 6 (Communication and interaction)

Danmaku is favored by Internet and cinema audiences for its unique interactive communication mode [4]. After being introduced into the field of education and teaching, scholars also focus on its unique interactive communication mode. Therefore, how to use Danmaku technology to improve the interaction status of undergraduate classrooms is the research focus of researchers.

### 3.3. Analysis of Keywords with the Strongest Bursts

The analysis of emergent words can obtain the forefront and trends in the research field. Using CiteSpace's mutation word detection algorithm, extract mutation terms from the sample literature. The higher the mutation value, the greater the magnitude of change in the keyword in a short period of time. A total of 9 Keywords with the Strongest Bursts words were obtained as shown in Figure 2.

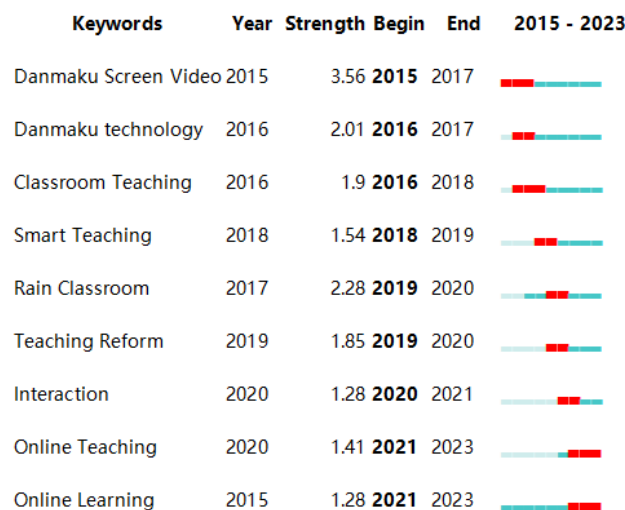


Figure 2: Keywords with the Strongest Bursts

It can be seen that in 2016, when Rain Classroom was first put into use, words such as "classroom teaching", "Danmaku technology", and "application" began to emerge, indicating that the real-time Danmaku function of Rain Classroom has attracted the attention of frontline educators and researchers from all walks of life. At this time, scholars' research on the application of Danmaku technology in teaching mainly focused on how to better integrate Danmaku technology into classroom teaching, and more importantly, whether Danmaku can truly improve classroom teaching effectiveness. In recent years, due to the impact of the epidemic, online teaching has flourished. China's largest Danmaku video website, Bilibili, commonly known as Bilibili, has also begun to delve into the field of education and teaching. The platform itself not only encourages self-media to share knowledge videos and learning resources, but also invites many elite educational content to join. This measure directly enriches learning resources and diversifies the forms of online learning. Many researchers have keenly discovered this research hotspot and begun to focus on the Danmaku phenomenon in the field of non-positive learning, as well as the impact of Danmaku culture on learners.

## 4. Conclusions and Discussion

### 4.1. Conclusions

Overall, the research hotspots in this field, apart from Danmaku technology itself, mainly focus on teaching forms (classroom teaching, online learning), Danmaku technology platform (Rain Classroom), and its most important function - interaction. Researchers are enthusiastic about discussing the use of the Danmaku technology platform to integrate Danmaku technology into interactive classroom teaching and online learning, creating real-time communication scenarios for learners, and thus stimulating their learning interest.

From the co-occurrence analysis of keywords, it can be seen that sentiment analysis of Danmaku used by students plays a crucial role in this field, but it has not received enough attention from researchers. Previous studies have found that Danmaku learning involves more direct ways for learners to express emotions and more frequent emotional communication [6]. However, most of the related research remains at the theoretical level, with less empirical research; Cluster analysis of keywords reveals that Danmaku is also used in other cultural venues such as libraries, mainly for informal learning scenarios and cultural promotion. However, there is also a problem of limited and insufficient research on related topics; Analyzing the emergence time of emerging words reveals a shift in research hotspots in recent years, gradually shifting from classroom teaching and online learning in formal learning to autonomous online learning in informal learning. More and more video learning resources are presented in the form of Danmaku videos, and the Danmaku platform that researchers focus on is gradually shifting from Rain Classroom to Bilibili.

Specifically, the application of Danmaku technology in classroom teaching began with the birth of Rain Classroom. Researchers have integrated the Danmaku technology on this platform with various subject courses to explore the promoting effect of Danmaku on specific subject teaching; Secondly, there is online teaching. The pandemic has forced teachers to innovate online teaching methods, and how to use Danmaku technology to enhance learners' spatial proximity is a research hotspot during this period. Researchers are more concerned about how to improve the effectiveness of online learning for students with the help of Danmaku; Finally, with the continuous advancement of educational informatization, the rapid development of online education, and people's increasing attention to the learning function of social media platforms, more and more teaching resources are produced into Danmaku videos to be presented to students. This makes the application of Danmaku in teaching not limited to the classroom. Although this application is beneficial for students to digest and absorb resource content in a timely manner, Danmaku culture, the negative impact of Danmaku on learners has also attracted the attention of scholars.

With the large-scale application of micro courses, MOOCs, and flipped classrooms, as well as the exploration of social Danmaku websites in the field of education, more and more Danmaku video courses will be introduced into teaching practice. However, existing research often focuses on the integration of Danmaku functions and teaching content, and pays more attention to its impact on classroom interaction modes. Few empirical studies also focus on the impact of Danmaku on academic performance. However, there is still a lack of empirical research on whether Danmaku can truly promote interaction and student learning, and similarly, its application in learning analysis should also be given attention. Therefore, in order to further clarify the educational value and significance of Danmaku, researchers need to adopt multiple research methods and conduct interdisciplinary research from an interdisciplinary perspective.

### 4.2. Discussion

#### 4.2.1. The Challenges of Danmaku Technology in Teaching Applications

After conducting an inductive content analysis of nearly 1000 Danmaku texts from online lecture videos, researchers found that Danmaku related to video content enhanced interaction among learners, increased classroom participation, and improved learning experience [7]. Many researchers have reached this conclusion, but also pointed out that Danmaku creates more cognitive load for learning [8]. Scholars have also pointed out that Danmaku brings a lot of visual fatigue, visual pollution, visual dependence and other chaos to teaching videos, which also poses a serious challenge to the ideological and political education of college students [9]. Therefore, the author believes that exploring the mechanism by which Danmaku promotes learner learning effectiveness, while affirming the positive role of Danmaku in teaching, exploring how to avoid its negative impact, reduce students' cognitive

load, and promote the application of this technology in the field of teaching should be a hot research topic in the future.

#### 4.2.2. The Application of Danmaku Technology in Learning Analysis

Previous studies have utilized Danmaku text to analyze users' emotional tendencies in order to understand their psychological characteristics<sup>[10]</sup>; Scholars also use the cluster algorithm to analyze the characteristics of Danmaku data and the emotions it expresses, and classify users<sup>[11]</sup>; Scholars have also found through research that conducting discourse analysis on Danmaku in teaching videos can help teachers better understand the online learning culture based on Danmaku interaction technology<sup>[12]</sup>, in order to carry out online teaching more effectively. It can be seen that sentiment analysis and discourse analysis of Danmaku text can obtain a large amount of relevant information about user operations, in order to more accurately support further user operations. However, existing research mostly focuses on the fields of computer science and media, and there is an extreme lack of research from an educational perspective. If the analysis of Danmaku can be applied to the teaching field, it will inevitably be able to more accurately analyze the learning status of students. Teachers and Danmaku technology platforms can also use this to more accurately push resources to assist their learning.

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#### References

- [1] Jingjing Zhang, Yehong Yang and Xin An. 2017. Enabling learning interaction through "bullet screen" videos [J]. *Distance Education In China* (11):9.
- [2] Yang Jiumin, Wu Changcheng, Pi Zhongling, Xie Heping. 2019. Facilitating Learning or Interfering Learning: A Meta-analysis of Impact of Danmaku on Learning [J]. *E-education Research*, 40(06): 84-90+120.
- [3] Wang Juan, Chen Shichao, Wang Linli, Yang Xianmin. 2016. The Analysis of Research Hot Spot and Trend on Big Data in Education based on Cite Space[J]. *Technology in Education*, 26(02): 5-13.
- [4] Li Haifeng, Wang Wei. 2015. The Barrage Video: A New Orientation about Online Video Interactive Learning [J]. *Technology in Education*, 25(06):12-17.
- [5] Wang Shuaiguo. 2017. Rain Classroom: The Wisdom Teaching Tool in the Context of Mobile Internet and Big Data [J]. *Technology in Education*, 27(05):26-32.
- [6] Chen Y, Gao Q, Rau P L P. 2017. Watching a Movie Alone yet Together: Understanding Reasons for Watching Danmaku Videos [J]. *International Journal of Human-Computer Interaction*, 33(7-9): 731-743.
- [7] Lin X, Huang M, Cordie L. 2018. An exploratory study: using Danmaku in online video-based lectures [J]. *Educational Media International*, 55(3):273-286.
- [8] Pi, Zhongling. 2019. Danmaku Related to Video Content Facilitates Learning. [J]. *Journal of Educational Technology Systems*, 47.
- [9] Li M, Xie F. The Dream of Socialist Core Accomplishment "The Belt and Road Initiative" Practice in Colleges and Universities[C]. *International Conference on Social science and Education Research 2018*. DOI: 10.2991/SSER-17.2018.50.
- [10] Wang S, Chen Y, Ming H, et al. 2020. Improved Danmaku Emotion Analysis and Its Application Based on Bi-LSTM Model [J]. *IEEE Access*, PP (99): 1-1.
- [11] Hong Qing, Wang Si, Yao, Zhao Qinpei, Li Jiangfeng, Rao Weixiong. 2018. Video user group classification based on barrage comments sentiment analysis and clustering algorithms.[J]. *Computer Engineering & Science*, 40(06):1125-1139.
- [12] Ding Guodong, Du Hua. 2021. Critical Discourse Analysis on Danmaku Texts of Teaching Videos-Taking a Set of High School Physics Teaching Videos on Bilibili Website as an Example [J]. *Technology in Education*, 31(07):72-79.