

Original Paper

Hot Topics and Trends in Research on PAD Class in China—Visual Analysis Based on CNKI Core Journals

Jiayi Li

College of Education, Huanggang Normal University, Huanggang, China

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Abstract

As a localized and innovative teaching mode, PAD Class successfully integrates the advantages of lecture-based and discussion-based teaching modes. This mode fully embodies the educational concept of "taking students as the main body and teachers as the leading factor". It can significantly stimulate students' autonomy and creativity, and then improve teaching efficiency and teaching quality. In this study, the core journals related to "PAD Class" included in CNKI were analyzed based on CiteSpace by using bibliometric methods. Visual analysis is carried out from the dimensions of research volume, research authors, research institutions and research hotspots. It is concluded that the number of core journals published in the class is a convex parabola; More than half of them rely on various fund projects and are supported by national policies, and their research has a certain depth and breadth; The research shows the development trend of group cooperation, multi-person participation and team inheritance; It integrates students' thinking accomplishment, professional accomplishment and ideological and political education, and is developing towards diversification. Through the analysis, it is expected to provide valuable reference for the follow-up study. Promote the further development of the innovative teaching mode of split class.

Keywords

PAD Class, visual analysis, teaching model

1. Foreword

PAD Class is an innovative teaching mode proposed by Professor Zhang Xuexin in 2014. Its core idea is to divide the class time and allocate half of the time to teachers to teach knowledge. The other half is allocated to students for internalization and interactive learning in the form of discussion. The lecture and discussion time are staggered in the class, so that students can arrange their own study for a week after class. Individualized internalization and absorption will be carried out, and "teachers teach in

class" will be changed into "students report in class". Its main innovation is "task division, power and responsibility division", which is the division of class tasks and time. It is also the division of rights and responsibilities between teachers and students (Zhao & Zhang, 2018).



Figure 1. Basic Principles of PAD Class

This teaching mode aims to stimulate students' autonomy and creativity, while improving teaching efficiency and quality. At present, the traditional teaching mode in China is mostly teacher-led "cramming" teaching. Western teaching encourages students to participate in discussions, and it is difficult for teachers to control the class. The PAD Class effectively integrates the advantages of these two teaching modes and fully embodies the principle of "student-centered". The educational concept of "teacher-led".

As a localized innovative teaching mode in line with the Chinese teaching situation, since it was put forward in 2014, it has attracted wide attention from many parties. In order to systematically understand the research status of sub-class in China, this study uses bibliometrics and knowledge mapping methods. This paper makes a visual analysis of the core journals related to the division class included in CNKI. It objectively combs and evaluates the current situation of domestic PAD Class research, and reveals the research hotspots in this field. It also looks forward to the development trend of continuous deepening research in the future, and provides some reference for follow-up research.

2. Research Methods and Data Sources

The study adopts bibliometric analysis method and uses CiteSpace 6.2.6 software for visual analysis. The data of the study were collected from the core journal database of CNKI.

The method of bibliometrics is used to analyze the number of papers, authors, publishing years, sources of journals, subject distribution and other aspects of the subject field. A multi-angle statistical analysis was conducted to delimit the author group of the discipline. It also analyzes the background, development overview and breakthrough achievements of the discipline, and reveals the dynamic structure and development direction of the discipline (Li & Duan, 2018). Knowledge mapping is a diagram used to reveal the relationship between the development status and changes of scientific knowledge structure (Wu & Chen, 2018).

The research on the PAD Class in China began in 2014 by Professor Zhang Xuexin, so the retrieval

time span is set from 2014 to November 30, 2023. In HowNet, the theme is "PAD Class". The source categories of core academic journals such as SCI, CSSCI and Peking University Core were selected for accurate search, and 138 literature data were retrieved. After manual reading and screening, 132 valid data were finally obtained. Select the RefWorks format to export the reference, and use CiteSpace6.2 to convert the valid data.

3. Research and Analysis on the Core Journals of Class-Based HowNet

3.1 Analysis of the Number of Documents Issued Annually

The number of papers published annually is an important indicator to measure the research heat and development trend. Setting the time slice as one year, the overall trend of the number of annual papers published on sub-class research in China in the past 10 years is shown in Figure 2. It is characterized by a convex parabola, and its attention has gradually increased since 2016, reached its peak in 2020, and then gradually declined.



Figure 2. Annual Number of Publications

Influenced by the policy environment in different periods, the research on sub-class in China has the characteristics of stages, which can be roughly divided into three stages:

1. Germination period (2014-2016)

In 2014, the first and only core journal paper on "PAD Class" was published. This paper elaborates on the relevant concepts, implementation methods and successful experience of the PAD Class. This paper has attracted wide attention in the educational circles and has become an important force and cornerstone to promote the reform of the national teaching mode. No core journal papers were published in 2015, and 9 core journal papers were published in 2016. The quality of papers has been improved and the forms of papers have been diversified, and six of them have been supported by funds, more than half of them. It shows that the theoretical research and practical application of "PAD Class" are supported by national policies.

2. Acceleration period (2017-2020)

Since 2017, the number of literature on "PAD Class" has accelerated, and the attention of related fields has continued to rise. In 2020, affected by the epidemic, all kinds of school teaching turned to online, and the "PAD Class" presented a new model. In 2020, Zhang Xuexin's team launched the national initiative of Online PAD. The "PAD class" of half of the teacher's intensive lecture, half of the academic internalization and half of the discussion is expanded to 30 minutes for the teacher's intensive lecture and 10 minutes for the students' internalization. The group discussion lasts for 15 minutes and the teacher answers questions for 20 minutes. It provides theoretical support and practical reference for teachers across the country to carry out "PAD Class" online teaching (Hou, Chen, Dai, et al., 2023). In 2020, it is the peak period of "PAD Class" research, and the total number of core journal documents in the whole year is 29. It is a year of "blowout" of research results. Chen Zhichao et al. (2017) applied this student-centered teaching concept to the practical exploration of ideological and political courses in Colleges and universities; Liu Mingqiu (2018) conducted a feedback analysis on the effect of PAD Class in biology teaching; Kong Xiangyu et al. (2018) made a comparative analysis based on the two popular teaching modes of SPOC flipped class and PAD Class.

3. Buffer period (2021 to date)

After 2021, with the return of offline campus education to normal, the enthusiasm of the teacher team for the study of "sub-class" has gradually stabilized. The theoretical research is relatively mature, and the number of core articles is gradually declining. However, the research direction is constantly innovating, and a large number of scholars are committed to integrating the PAD Class with other teaching modes in order to achieve efficient teaching. The goal of efficient absorption by students. Zhang Jing et al. (2021) studied the application of MDT-based PAD Class combined CBL teaching mode in clinical teaching of soft tissue tumors; Sun Chuanmeng et al. (2022) studied the teaching mode of intelligent control course integrating OBE and PAD concepts.

3.2 *Distribution of Research Institutions and Personnel*

According to the publishing institutions, Fudan University in Shanghai has the highest number of articles, with 8 articles. The second is Shanghai Institute of Electrical Engineering, which has published 7 articles. Other universities, primary and secondary schools, education departments, education research centers and medical colleges have published 1 to 2 articles. According to CiteSpace's map of the number of publications, the regional distribution of institutions is examined. East China, represented by Shanghai, is the main force in this field and the first to invest in research. The early research focuses on teaching in colleges and universities.

In terms of authors, Zhang Xuexin published 5 articles, Chen Ruifeng 4 articles, Zhang Chenglin 4 articles, Liu Mingqiu 3 articles and Wan Chunyun 3 articles, with the highest number of articles. Their research fields are mainly higher education, among which Liu Mingqiu and Wan Chunyun are in the fields of microbiology and veterinary medicine respectively. The simultaneous signatures of different authors are taken as the indicators of team inheritance. According to the statistics of class research

teams in three categories of literature writing, group inheritance and multi-person cooperation, 132 papers were published. There are 38 articles written by a single author, accounting for 28.79%. There are 35 papers signed by 5 or more people, accounting for 26.52%. Among them, two scholars, Zhang Xuexin and Chen Ruifeng, have the greatest influence on inheritance, and the number of papers signed with others is 9, accounting for 6.82%. In a word, the research of "PAD Class" shows the development trend of group cooperation, multi-person participation and team inheritance. This reflects the exploration and pursuit of the new teaching mode in the educational circles.

3.3 Research Keyword Analysis

1. Statistical analysis of keyword frequency

Keywords are the author's refinement of the core content of the study, and the frequency and centrality of keywords are important indicators to identify research hotspots. According to CiteSpace analysis, the keywords with centrality > 0.05 are shown in Table 1 below, where the centrality value of "PAD Class" is 1.67. The frequency of occurrence is 94, which is the core node in the knowledge map and the central hub connecting other keywords. In this field, researchers pay more attention to the application and practice of PAD classes in the teaching of various disciplines and professional subjects in colleges and universities. Researchers pay more attention to the innovation and reform of teaching mode.

| 频次 (Frey) | 中心度(Centrality) | 关键词(Keywords) |
|-----------|-----------------|---------------|
| 94 | 1.67 | 对分课堂 |
| 20 | 0.1 | 教学模式 |
| 15 | 0.14 | 教学改革 |
| 4 | 0.08 | 护理教育 |
| 4 | 0.05 | 教学 |

Table 1. Centrality and Frequency of Key Words in PAD Class Study

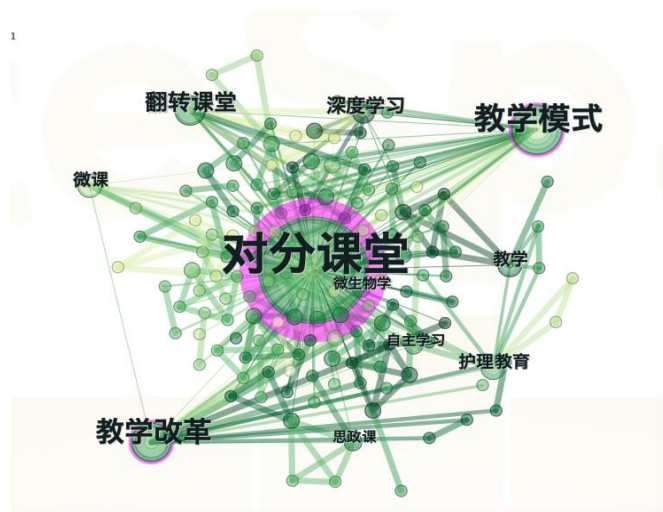


Figure 3. PAD Class Keyword Co-Occurrence Map

2. Keyword Emergence Analysis

Combined with the Burst Detection function of CiteSpace software, it can accurately locate the rise and fall of a keyword. Identify the development stage of hot research (Yan & Zhou, 2023). Through the keyword mutation coefficient test ($\gamma = 0.2$), 10 emergent words were obtained. They are: internalization and absorption, teaching mode, college students, autonomous learning, teaching design, cognitive combing, value care, ontological elaboration, teaching and sex for a time." Internalization and absorption" is the key word with the earliest emergence time, and its research is hot and lasts until 2018. Since 2021, the latest focus of attention has been "gender one degree" and continues to this day. Wu Yan, director of the Department of Higher Education, first put forward the construction standard of "Golden Course"- "Gender" at the 11th "China University Teaching Forum". "One degree", that is, high-level, innovative and challenging (Wu, 2018). This research trend is consistent with the relevant guidance of the Ministry of Education. It further proves the importance and value of "PAD Class" in educational reform.

Top 10 Keywords with the Strongest Citation Bursts

| Keywords | Year | Strength | Begin | End | 2014 - 2023 |
|----------|------|----------|-------|------|-------------|
| 内化吸收 | 2014 | 0.85 | 2014 | 2018 | |
| 教学模式 | 2016 | 1.84 | 2016 | 2017 | |
| 大学生 | 2017 | 0.66 | 2017 | 2019 | |
| 自主学习 | 2018 | 0.55 | 2018 | 2019 | |
| 教学设计 | 2020 | 0.62 | 2020 | 2021 | |
| 认识梳理 | 2020 | 0.62 | 2020 | 2021 | |
| 价值关照 | 2020 | 0.62 | 2020 | 2021 | |
| 本体阐释 | 2020 | 0.62 | 2020 | 2021 | |
| 教学 | 2020 | 0.59 | 2020 | 2023 | |
| 两性一度 | 2021 | 0.77 | 2021 | 2023 | |

Figure 4. PAD Class Keyword Emergence

3. Keyword cluster atlas analysis

High-frequency keywords in the field of dichotomous class research are clustered to reveal the research topics in this field. This clustering generates a knowledge map with 157 nodes, 334 links and 10 clusters, as shown in Figure 4. The Modularity and Silhouette were 0.5558 and 0.9371, respectively. It shows that the clustering effect is obvious and the reliability is high.

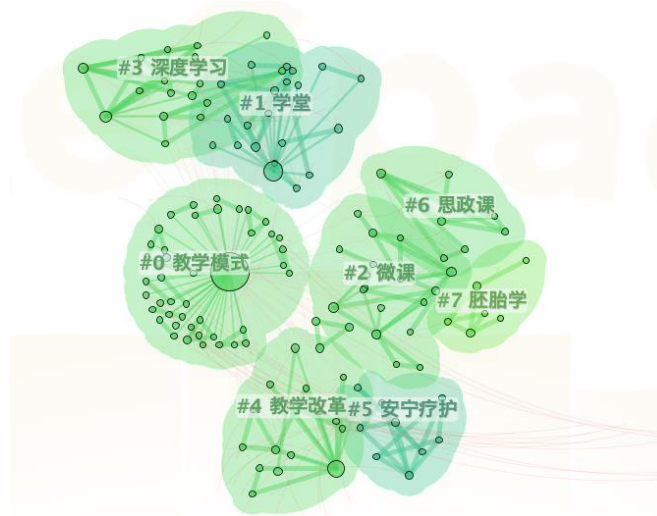


Figure 5. PAD Class Research Hotspot Cluster Map

3.4 Research Hotspots and Content Analysis

According to the clustering atlas of research hot spots of smart homework drawn by CiteSpace, the research hot spots clustered in the front are analyzed.

"Teaching mode" is the largest cluster theme. Chen Ruifeng (2016) believes that the generative class teaching mode should be explored. Promote the effective generation of curriculum standards, generative resources and class teaching process itself; Liu Shaogan and other scholars (2019) believe that the PAD Class combines constructivism with traditional teaching mode. It effectively integrates the advantages of traditional teaching method and discussion method, and implements the student-centered teaching concept. It emphasizes interaction and autonomous learning, aiming at improving students' critical thinking ability. It is a new teaching mode aiming at the crux and improving the thinking ability. Today's education requires all-round development of morality, intelligence, physical fitness, beauty and labor, but there is an imbalance between "church" and "school" in the current aesthetic education teaching. It is either the teacher's one-way teaching, the aesthetic education class becomes the "church" of aesthetic knowledge, or the student's unilateral exploration. Aesthetic education class has become the "school" of skill training. The division of the class realizes the division of "church" and "school", so that teachers can not only elaborate on aesthetic theory, it also enables students to gain the understanding, exploration and experience of beauty through participation. The PAD class conforms to the characteristics of aesthetic education and helps to improve students' aesthetic ability and creativity (Xu & Zhang, 2021).

Paired class research also shows a trend of integration with students' professional accomplishment, the most prominent of which is biology and medicine. The PAD class can stimulate the learning enthusiasm and initiative of medical students, and promote their in-depth understanding and thinking of professional knowledge. Through the implementation of the PAD Class, medical students can exercise

their ability to raise questions, analyze problems and solve problems. Improve their knowledge summary ability and voice expression ability. At the same time, it can also enhance their teamwork ability, sense of responsibility and respect for others. Ultimately improve the overall quality of medical students.

Teachers use the teaching method of "PAD Class" to promote the gradual growth of students' thinking in generative class. It can promote students to change from passive learning to active learning, and gradually realize the transformation of students' thinking quality. It is helpful for students to carry out in-depth learning and make full use of fragmented time to cultivate students' thinking literacy. The innovative practice of this teaching mode will inject new vitality into higher education and promote the reform of education and teaching. So that it can continue to develop and progress. In the aspect of ideological and political education, the introduction of PAD Class teaching mode into ideological and political courses in Colleges and universities can effectively enhance students' subjective consciousness. Enhance emotional identity.

4. Future Research Trends

The promotion and application of the teaching mode of separate courses will help to deeply integrate students' thinking literacy, professional literacy and ideological and political education. It is a practical application research based on multi-disciplinary, multi-platform, multi-team and multi-fund. This kind of teaching mode can become the teaching method innovation of quality education at all levels. However, a single teaching mode is difficult to meet the teaching needs of the current teaching reform background. Only by integrating various teaching modes can we inject internal impetus into the optimization of teaching exploration and practice. And then to promote the development of China's education towards a deeper level to provide impetus.

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