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Yuqin Jiang[1,2], Nor Junainah Mohd Isa[1], Priyalatha Govindasamy[1], Lyuci Zhang[2,3]

[1]Faculty of Human Development, Universiti Pendidikan Sultan Idris, Tanjung Malim, Perak, 35900, Malaysia, [2]Department of Education and Music, Hezhou University, Hezhou 542899, China, [3]Faculty of Educational studies, Universiti Putra Malaysia, Serdang 43400, Malaysia
Email: gpriyalatha@fpm.upsi.edu.my, jiangyuqin1006@gmail.com, zhanglvci1006@gmail.com
Corresponding Author's Email: junainah@fpm.upsi.edu.my

Abstract
This study aimed to explore the current status and hotspots of research on Chinese boarding students. Literature on research studies studying Chinese boarding students from January 1, 2010, to December 30, 2022, was retrieved from the China National Knowledge Infrastructure Database (CNKI). CiteSpace 6.1.R6 software was used to visualize and analyze authors, institutions, and keywords. In total, 416 papers were included. The results found that (1) research about boarding students in China has shown a steady increase over a decade, but has shown a fluctuating downward trend since 2016. (2) In the process of researching boarding students, a more central network of research institutions has formed, comprising a complex collaborative network centered on the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention, as well as key figures such as Sun Jing, Pu Wei, and Ma Guansheng. (3) From multiple dimensions of keywords, clustering, and mutation, rural boarding students from elementary school to high school are a group that has received high attention; education and physical health status issues, mental health, and school adjustment have been research hotspots from the time the group was established to the present. (4) The frontiers of research on boarding students are focused on school adjustment, cognitive skills, peer relationships, psychological capital, and physical activity.
Keywords: Boarding Students, CiteSpace, Research Frontiers, Research Hotspots, China

Introduction
As China's urban construction accelerates and the rural population decreases, some rural schools in sparsely populated areas are experiencing a pattern of empty schools with few students, small schools with many teaching points, and large investments in education

resources. Therefore, the government is reevaluating the locations of schools. In September 2003, China's State Council issued a policy to further strengthen the construction of primary and secondary school buildings and junior high school boarding schools. Accordingly, they launched the "Rural Boarding School Construction Project in the Western Region" from 2004 to 2007. At this point, the boarding school system is in full swing in China, boarding schools were established in large numbers, and the number of boarding students increased dramatically (Li et al., 2018). Statistics from the Ministry of Education in 2011 showed that there were 32,765,100 boarding students in compulsory education, accounting for 21.85% of the total number of students in school (Huang et al., 2017). In terms of boarding scale, in 2016, there were 26,082,064 boarding students in compulsory education in rural areas, accounting for 84.80% of all boarding students nationwide. Among them, there were 9,425,228 rural elementary school boarding students, accounting for 88.61% of all elementary school boarding students nationwide, and 16,656,836 rural junior high school boarding students, accounting for 82.78% of the total number of junior high school boarding students nationwide. In terms of the boarding rate, from 2006 to 2016, the boarding rate of compulsory education in rural areas increased from 19.67% to 27.50%, an increase of 7.83 percentage points. Among them, the boarding rate of rural elementary schools increased from 7.36% to 14.18%, nearly doubling the boarding rate. Additionally, the boarding rate of rural junior high schools increased from 42.07% to 58.65%, an increase of 16.58 percentage points (Yang et al., 2011). Therefore, it is necessary to conduct more research about this large and special population.

The large residential student population has gained the attention of the government and academics. There are also several previous studies on boarding students. Firstly, regarding the living conditions and health of boarding students, Wang et al (2016) examined the nutritional status of rural boarding students using a large pooled dataset comparing dietary nutrition, health, and educational outcomes of boarding school students from 59 rural counties in five provinces in China and found that the intake of key nutrients among rural boarding school students was generally inadequate. Wang et al (2020) found that anemia, iron deficiency, and folic acid deficiency were more severe among students in Western China than in Central China, and vitamin B12 deficiency was more severe among students in Central China than in Western China. There were regional differences in the nutrition of students in rural boarding schools, and student nutrition needs to be improved. Li et al (2017) found that boarding students have relatively poorer nutrition and health levels compared to non-boarding students. In addition, Luo et al (2017) investigated the nutritional health status of elementary school boarding students in Xinjiang Construction Corps and found that overnutrition and undernutrition existed simultaneously. These studies found that the physical health conditions of boarding students were poor. Secondly, research on the mental health of boarding students has begun to emerge in recent years with large-scale data on boarding schools, and studies have found that boarding has a significant negative impact on children's mental health (Zhu et al., 2019). Using CFPS data, Shu and Tong (2015) identified that students in boarding schools were more likely to be depressed. These studies found that the mental health of boarding students was concerning. The third was a study on the management of boarding students. Rural boarding systems have played a role in promoting educational equity, integrating educational resources, and improving school efficiency, but rural boarding schools have a series of management problems in infrastructure development, internal management systems, and interaction with families and communities (Jiang, 2018). Finally, research has been done on school adjustment among boarding students. Many

studies have found that boarding students' school adjustment is not optimistic, and compared to day students, boarding students are more likely to experience various mental health problems, such as depression and anxiety (Xiao et al., 2008; Zhang et al., 2009).

Analysis of the studies done by experts in different fields reveals that research on boarding students has produced useful results. Therefore, a review of the past results shows that the research on the evolution of boarding students and hot issues is almost in a gap, which is not conducive to an overall grasp of the boarding students' problems but also does not encourage the adjustment and improvement of boarding school policies by the relevant departments. Therefore, in order to have a holistic and unbiased overview of the study of residential students, the author used CiteSpace software to measure and analyze the relevant literature in the field of research on boarding students from 2010-2022, fully utilizing the advantages of visual knowledge mapping to summarize and conclude the findings. Specifically, this study included the following four research objectives:

(1) To explore the characteristics of the volume of research publications on boarding students.
(2) To explore the characteristics of author and institutional collaboration in the field of research related to boarding students.
(3) To explore the characteristics of the distribution of research hotspots for boarding students.
(4) To understand the characteristics of time variables and research frontiers in recent years in the study of boarding students.

Materials and Methods
Research Tools
CiteSpace is an information data visualization tool for academic literature analysis. It can reveal the hot topics and their evolution in a certain discipline or field in multifaceted, time-sharing, and dynamic complex network analysis. CiteSpace has been widely used to explore and track the hotspots and future trends of disciplinary research frontiers, as well as the intricate relationships between current research hot spots and general basic knowledge of different research hot spots or frontiers. The function buttons of CiteSpace software mainly include Keyword, CitedAuthor, CitedJournal, CitedReference, etc. In academic papers, keywords are an integral part of the article, and keywords directly reflect the current trends related to a research field (Chen, 2006, 2014).

Data Source
The basis of CiteSpace knowledge mapping is the collection and acquisition of sample data. Therefore, this study conducted a subject search in the China National Knowledge Infrastructure Database (CNKI) with "subject = boarding, boarding students", the literature type was journals, and the period was selected as 2010-2022. To ensure the comprehensiveness, scientificity and validity of the research sample, the author manually screened the retrieved literature and obtained a total of 416 documents after eliminating invalid documents, which involved author, title, abstract, keywords, references, and other information.

Research Framework
This study used the China National Knowledge Infrastructure Database (CNKI) source journals as its main source. To improve the accuracy of the study, 416 valid documents were obtained after de-duplication and elimination of irrelevant documents such as book reviews, reports,

and conference announcements. On this basis, CiteSpace 6.1.R6 software was used to statistically analyze the authors of the issued articles, research institutions, mutation words, and keywords, and then perform co-occurrence analysis sequentially to generate a visualization map. Thus, the research hotspots and current status of the field were summarized, and the frontiers and trends of research development in the field were analyzed as shown in Figure 1.
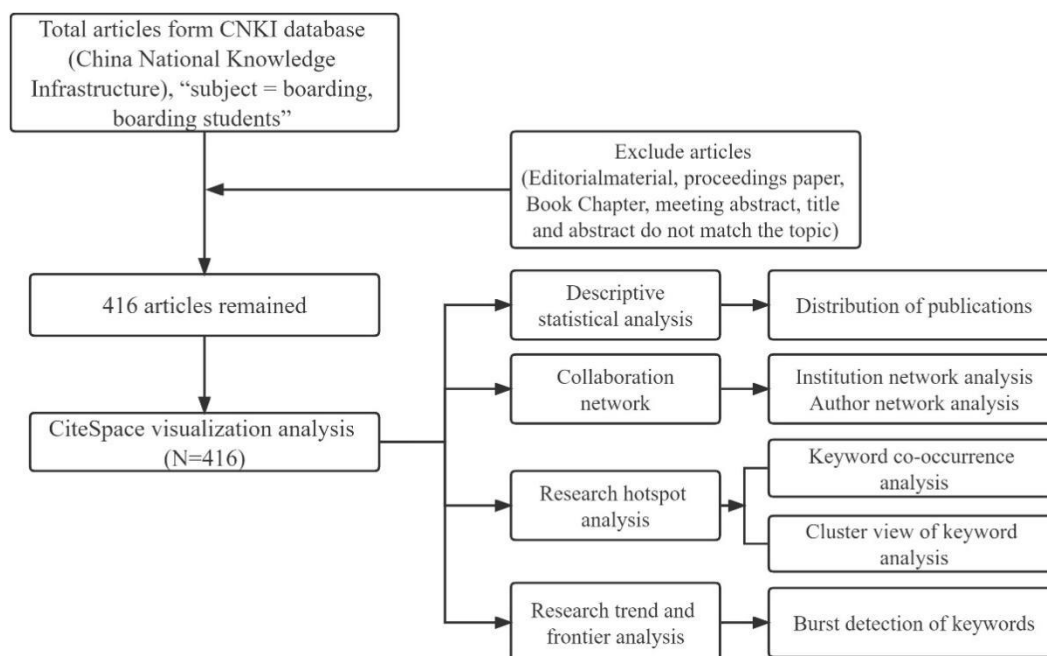

Figure 1 The research framework

Results

This section summarizes and synthesizes boarding student-centered research by analyzing the basis of the collected literature, co-citation analysis, and keyword co-occurrence analysis. This study analyzes the basic information of the sample papers, including the frequency statistics of key publications, journals, researchers, and institutions, which helps to assess the current status of research on boarding students in China. Co-citation analysis for the authors, sources, and studies frequently cited in the sample papers helps to expand the knowledge base in the field of boarding students. The co-occurrence analysis of keywords constitutes a hot topic in studies of Chinese boarding students. Finally, based on the extracted keywords for tense analysis, the sample papers help to summarize emerging development trends in scientific research in this area.

Research Publications

The number of publications in the literature is an important indicator of the trend of scientific research in the field, which to some extent, reflects the changes in scientific research knowledge and research progress in the research field (Xiao & Kong, 2014). To explore the current state of research about boarding students, this study surveyed published literature on "boarding students" from 2010 to 2022 (as shown in Figure 2). The literature for this phase is based on 2016 as a watershed year, and the general trend can be summarized as rising and then falling, which can be divided into two phases.

The first phase was the golden period when the number of literature works in the field of residential studies showed a steady increase from 2006 to 2016. The number of articles published on "boarding students" during this period has greatly enriched the research on boarding students, reaching a peak of 42 articles in 2016. During this period, the number of literature works was distributed more evenly with an average annual number of about 36 articles. The number of articles published in this period is 60.34% of the total literature, and the growth of the number of articles is more obvious, indicating that the research related to boarding students received wide attention from the academic community.

The second phase is a period of fluctuation and decline, with an overall downward trend in the number of articles published in the field of residential student research from 2017.
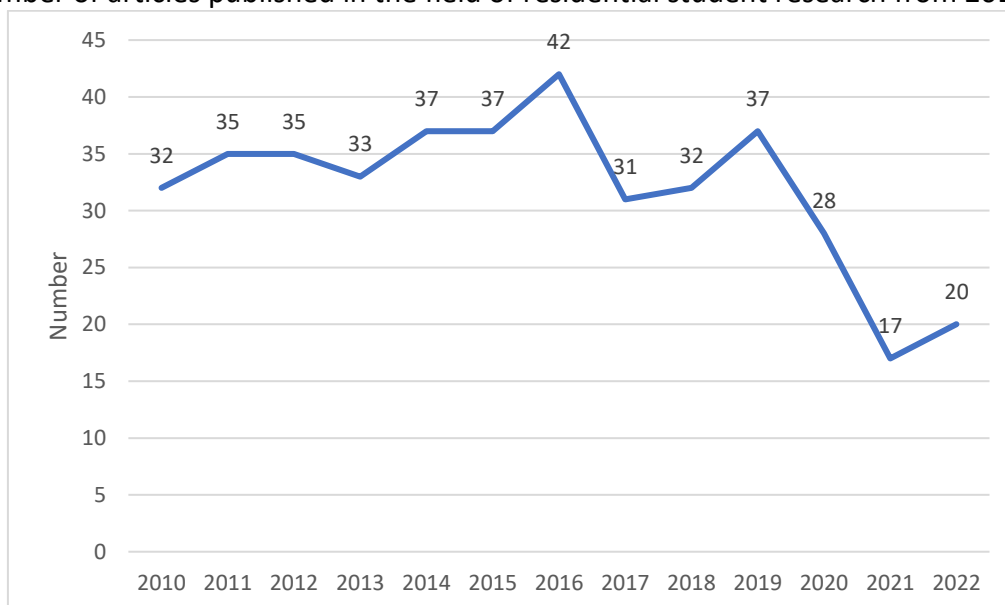

Figure 2 The number of boarding student papers published in China

Collaboration Network

Currently, boarding students are receiving varying degrees of attention from scholars and institutions in China, but with the reform of maternity policies, the future of the boarding student population in China will see significant growth, and research in this area will grow rapidly. As to whether authors and institutions have established a close partnership is an issue that needs to be clarified in the field of residential student research in order to explore the collaborative relationships between authors or institutions and to identify the main authors or institutions in research targeting the field. A co-authorship analysis was conducted using CiteSpace to generate author collaboration network graphs and institutional collaboration network graphs.

Researchers

The research relationships of scholars were analyzed using CiteSpace, and the results of the analysis were obtained as shown in Figure 3, after which an author graph analysis with the number of nodes N = 363, the number of connections E = 307, and the density of 0.0047 was obtained. The nodes in the graph represent the authors, and the size indicates the number of their posts. The larger the node, the more the author has posted, and the nodes that are not connected to each other are independent authors, which account for a higher proportion. The collaborative relationship between authors is represented by a line between nodes. From the analysis results, in general, author cooperation is also more scattered, failing to form a

collaborative group with greater impact. However, the boarding students also account for a certain proportion of collaborative research. One of the most obvious collaborative groups is shown in Figure 3; the line of cooperation is mainly concentrated among Huo Junsheng, Pu Wei, Huang Jian, Sun Jing, Wang Lijuan and other scholars. These authors are more connected to each other and cooperate more closely; the rest of the authors and institutions are more scattered. The network density of 0.0047 indicates that only 0.47% of the potential relationships in the network studies of boarding students were realized. This also reveals that strong partnerships between authors have not yet been formed in the field of boarding students. Overall, the collaborative relationships between authors are not obvious and are mostly independent studies.

Figure 3 Authors with a high frequency of co-citation

There were 14 researchers with four or more publications, and the top three researchers in terms of publications were Sun Jing (8), Pu Wei (7), Ma Guangsheng, Zhang Qian, Song Yingquan, Huo Junsheng, Li Jin, and Wang Lijuan (5). Among these 14 researchers, even the scholars with the highest frequency of publications are only in the single digits, indicating that the field has yet to attract great attention.

Institutions
The analysis of the collaborative relationships of the research institutions was performed using CiteSpace, and the results of the analysis were obtained as shown in Figure 4, which was analyzed to obtain an authorship graph analysis with the number of nodes N = 343, the number of connections E = 147, and a density of 0.0025. From the institutional cooperation mapping, it is clear that 343 institutions are issuing Chinese literature. The network density value is 0.0025, which indicates that the cooperation among institutions is not close, and they

are mostly independent studies. In the network mapping of institutional collaborative outputs, the absence of linkages between nodes indicates that the residential student literature was done independently by the institution, and the presence of linkages indicates that the residential student literature was a collaboration between two and more institutions. As shown in the figure, there are more obvious institutional cooperation networks formed. Firstly, a more complex cooperation network is formed with the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention as the core. Secondly, a network cooperation circle with the Faculty of Education of Beijing Normal University and others as members. This indicates that the collaborative network formed by these two institutions has a strong research capacity in the area of residential student research.
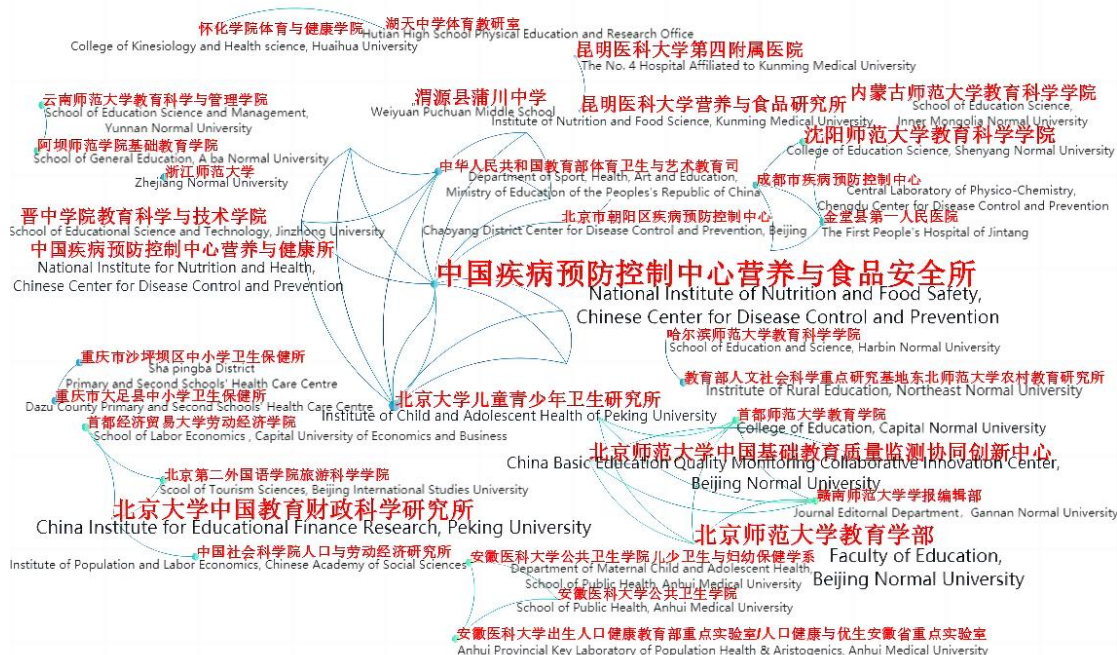
Figure 4 Institutions with a high frequency of co-citation

Statistics on the volume of publications from research institutions, as shown in Table 1, reveal that the top five institutions in terms of literature output are the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention, the Faculty of Education of Beijing Normal University, the China Institute for Educational Finance Research of Peking University, the China Basic Education Quality Monitoring Collaborative Innovation Center of Beijing Normal University, and the College of Education Science of Shenyang Normal University. These five universities contributed 8, 5, 5, 4, and 4 research papers, respectively. In addition, as an important scientific institution for boarding student research, the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention has had a significant impact on research in this field.

Table 1
Core institutions of boarding student studies in China

Frequency	Year	Institution
8	2010	Chinese Center for Disease Control and Prevention, the Faculty of Education. Beijing Normal University
5	2015	Faculty of Education, Beijing Normal University
5	2016	China Institute for Educational Finance Research, Peking University
4	2015	China Basic Education Quality Monitoring Collaborative Innovation Center, Beijing Normal University
4	2019	College of Education Science, Shenyang Normal University
3	2015	National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention
3	2012	The No.4 Hospital Affiliated with Kunming Medical University
3	2010	Institute of Child and Adolescent Health of Peking University

Research Hotspot Analysis
Since keywords provide a focused overview of the research content, this study conducted frequency analysis, keyword co-occurrence analysis, and cluster view of keyword analysis to understand the research hotspots of studies on boarding students.

Keyword Co-occurrence Analysis
The keyword clustering function of CiteSpace clearly shows the focus of a research area. Based on the results of the path detection algorithm, a clustering map of keyword co-occurrence frequencies for boarding students' research is derived (see Figure 5). The keyword co-occurrence map with the number of nodes N = 293, the number of links E = 543 and the density of 0.0127 is obtained after CiteSpace analysis. In the knowledge map, the keyword nodes are represented by circles, and the larger the circle is, the higher the frequency of the corresponding topic appears. The color and thickness of the nodal annual rings indicate the period of occurrence, i.e., the thicker the colored ring inside the circle, the higher the frequency of occurrence of that color in the corresponding year. The circles are, from largest to smallest: boarding system, boarder, mental health, students, rural, and boarding students. This suggests that these six keywords are the hot content in the field of boarding student research.

The table of intermediate centrality and chronological distribution of keyword co-occurrence frequency in the software was exported to obtain the "table of intermediate centrality and chronological distribution of keyword co-occurrence frequency of boarding students" (see

Table **2**). Table 3 shows the top 18 high-frequency words. A greater frequency indicates that the topic appears more often, and a higher centrality of the keyword represents a more obvious mediating role and a greater influence on other keywords. Combining Figure 5 with Table 3, it can be seen that, first, boarding students in rural areas who are at the junior high school level are the main research themes in the study of Chinese boarding students. Thus,

the high-frequency words that represent the research themes include students, boarder, boarding system, rural, rural population, middle school students, junior high school students, boarding students, left-behind children, and elementary school students. Second, in terms of research on boarding students, hot topics include mental health, nutritional status, cultivation education, loneliness, school adjustment, and peer relationships. Finally, there is also research on "countermeasures" to address the problems faced by boarding students.

Table 2
Top 10 keywords in the field of boarding students in China

| Rank	Frequency	Centrality	Year	Keywords
1	62	0.24	2010	Students
2	47	0.38	2010	Boarder
3	44	0.31	2010	Boarding system
4	40	0.23	2010	Mental health
5	24	0.08	2011	Rural
6	23	0	2010	Rural population
7	20	0.01	2010	Nutritional status
8	14	0.09	2010	Middle school students
9	14	0.06	2011	Junior high school students
10	14	0.08	2010	Boarding students
11	11	0.02	2010	Cultivation education
12	11	0.04	2010	Boarding
13	10	0.04	2010	Elementary school students
14	9	0.06	2010	Left-behind children
15	9	0.02	2010	Loneliness
16	8	0.03	2015	School adjustment
17	7	0.03	2011	Countermeasures
18	7	0.01	2011	Peer relationships
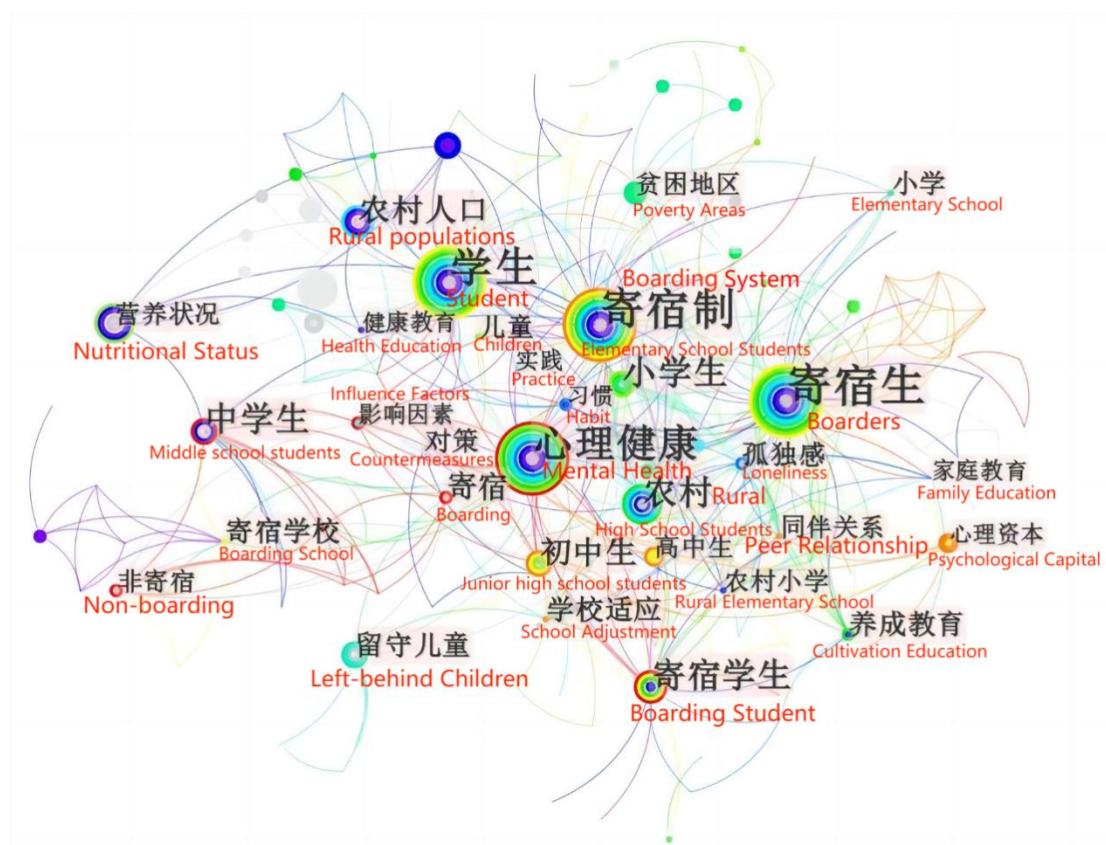
Figure 5 The keyword co-occurrence map for the field of boarding students in China

Cluster View of Keyword Analysis

Cluster analysis is the process of aggregation and classification based on the similarity of data, and keyword clustering can aggregate similar knowledge points into clusters, i.e., hot topics in the field. Each cluster represents a hot topic in this research area, and the keywords contained in the cluster labels are the hot frontier directions in this research area (Chen, 2014). To further observe the research hotspots of Chinese boarding students, this paper used the keywords in CiteSpace software for cluster analysis to draw a cluster visualization map of keywords for Chinese boarding students from 2010 to 2022 (as shown in Figure 6). Among them, the Modularity Q = 0.548 (> 0.3) and the Mean Silhouette S = 0.876 (> 0.7) of the clusters indicate that this clustering view is effective, with high reliability and a strong reference. From the keyword clustering mapping, there are seven main clusters, which are #0 students, #1 boarding system, #2 boarder, #3 junior high school students, #4 loneliness, #5 cultivation education, #6 rural, and #7 boarding school.

The above keywords were clustered and grouped together for analysis and organization, and the findings were reflected in seven areas (see Table 3). Category #0 is the largest category, consisting of 36 documents, including keywords such as rural population, nutritional status, urban housing status, interventional study, Kazak nationality, dietary habits, costs and charges, and health literacy. Its main focus is the study of the nutritional status of boarding students (Chen et al., 2018; Fang & Ma, 2010; Xu et al., 2014). Category #1 is the second major category, consisting of 35 papers including keywords such as left-behind children, psychological problems, educational strategies, analysis of the current situation, management measures, cultivation strategies, financial literacy, survey results, boarding high school students, and intensive management, mainly involving research on special groups of left-behind children among boarding students, as well as research on boarding students'

psychological problems, educational strategies, and management countermeasures (Ren & Wu, 2022; Tang et al., 2020; Zhu et al., 2019). Category #2 is the third major category, consisting of 32 papers including keywords such as rural elementary school, psychological capital, learning burden rural boarding schools, effective management, subject awareness, learning motivation, partner learning, and self-management. Mainly, low age at boarding (Hou et al., 2018; Yang et al., 2011), psychological capital (Ma et al., 2013; Wu et al., 2021), school performance (Tang et al., 2020; Zhao & Yu, 2017), and other related factors were studied. Category #3 is the fourth major category, consisting of 32 papers including keywords such as mental health, salt and oil survey, Tibetan areas of Qinghai, rural boarding schools, influencing factors, and dietary behavior. It mainly involved the study of boarding students' mental health and their boarding environment (Chen et al., 2020; Zhu, 2016). Category #4 is the fifth category, consisting of 23 papers including keywords such as peer relationships, boarding elementary school students, parent-child relationships, teacher acceptance, psychological capital, poor areas, and rural boarding systems. It mainly involved studies on social support for boarding students (Huang & Wu, 2021; Ma, 2017).

Through the analysis of keyword clustering of boarding students, combined with Figure 6 and Table 4, the research hotspots of boarding students are refined to show seven systematic summaries：

1. The distribution and groups of boarding students. In China, boarding schools are mainly located in rural areas of China and boarding elementary school students and boarding secondary school students are very common boarding groups. A large portion of the boarding student population is made up of left-behind children. Some of the keywords involved are left-behind children, rural children, and boarding elementary school students.

2. The mental health of boarding students. Past studies have obtained the corresponding findings by analyzing the current situation of boarding students' psychological problems and then going to factor analysis to get the influencing factors. One important study on mental health also focused on the sub-studies of psychological capital and loneliness. The keywords include current situation analysis, survey results, influencing factors, factor exploration, psychological capital, loneliness, mental health, and psychological problems.

3. The physical condition of boarding students. The specific research content contains nutritional status, sports injuries, dietary habits, health literacy, etc.

4. Social support for boarding students. The social support of boarding students mainly comes from peer relationships, parent-child relationships, teacher acceptance, and family support.

5. School performance of boarding students. School adjustment for boarding students includes learning burden, learning motivation, habit formation, instructional development, student habits, and student evaluation.

6. Education of boarding students. The education of boarding students includes family education, social education, and school education.

7. Boarding environment of boarding students. The description of the boarding environment includes the following: salt and oil survey, left-behind status, rural pastoral areas, boarding in Tibetan areas, dormitory culture, dormitory spiritual culture, poor areas, ethnic poor areas, and urban housing status.

Table 3
Cluster view of keyword analysis

| Type	Number of Literature	Clustered Keywords	Content included
0	36	Student	Rural population; nutritional status; urban housing status; interventional study; Kazak nationality; dietary habits; costs and charges; health literacy
1	35	Boarding system	Left-behind children; psychological problems; educational strategies; current situation analysis, survey results, influencing factors, factor exploration, psychological capital, loneliness, mental health, psychological problems; management measures; cultivation strategies; financial literacy; Survey results; boarding high school students; intensive management
2	32	Boarder	Rural elementary school; psychological capital; learning burden; rural boarding schools; effective management; subject awareness; learning motivation; partner learning; self-management
3	32	Junior high school students	Mental health; Salt and oil survey; Tibetan areas of Qinghai; rural boarding schools; influencing factors; dietary behavior
4	23	Loneliness	Peer relationships; boarding elementary school students; parent-child relationships; teacher acceptance; psychological capital, poor areas; rural boarding systems
5	20	Cultivation education	Cultivation education; dormitory culture; dormitory spiritual culture; secondary vocational school; factor exploration; boarding students; cultivation innovation; habit formation; ethnic poor areas
6	16	Rural	Family education; social education; school education; boarding primary schools; boarding students; boarding schools; sports injuries; rural pastoral areas; boarding in Tibetan areas
7	11	Boarding school	Boarding schools; gender diverse; boarding elementary students; comparison of differences; family support; instructional development; student habits; student evaluation
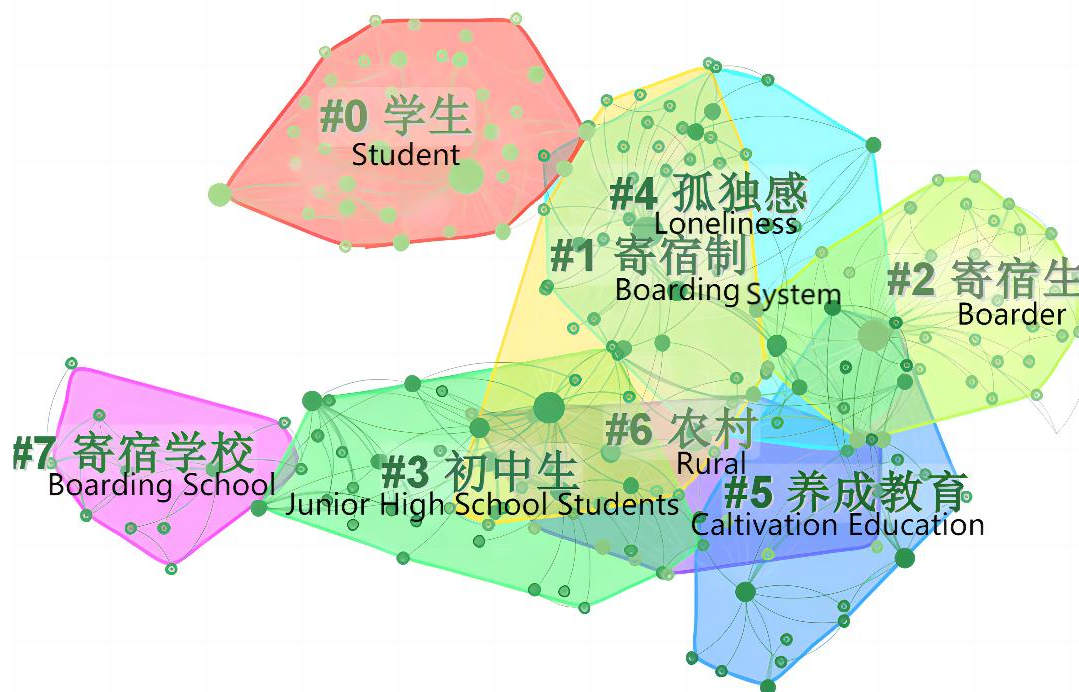
Figure 6 Map of the cluster view of keyword analysis

Research Trend and Frontier Analysis

A mutation is a word that appears more often or is used more frequently in a relatively short time. Based on the frequency of mutation words to determine the frontier and prospect of this field, the keyword mutation function was used to analyze the boarding students, and the results in Figure 7 were obtained. It can be seen that "nutritional status", "diet", "dietary "countermeasures", "psychological problems", "diet survey", "primary and middle school students", "habits", "health education," "rural," "school adjustment," "left-behind children", "financial literacy", "elementary school students", "secondary vocational students", "junior high school students", "cognitive skills", "peer relationships", "children", "high school students", "psychological capital", and "physical activity" are 21 terms that appear in the years 2010 through 2022.

The "strength" represents the emergence rate of each keyword. The larger the emergence rate data, the greater the attention of the keyword, and vice versa. According to the results of "strength", the first keyword with the highest centrality is nutrition, followed by diet survey, junior high school students, and psychological capital, all with a centrality of 2.5 or more. Second, scholars' research concerns on boarding students have varied over the past decade or so and can be broadly divided into two stages. In the early stage (2010-2015), scholars focused more on the dietary nutrition, psychological problems, and corresponding countermeasures of boarding primary and secondary school students in rural areas. In the late stage (2016-2022), scholars turned to focus on school adjustment, psychological capital, and cognitive abilities of boarding left-behind children and boarding secondary school students. Third, in terms of duration, the longest mutation in research on boarding students is "school adjustment," which begins in 2015 and continues until 2022, a total of seven years of sustained attention. Finally, for the speculation of recent frontiers of research on boarding students, the words "school adjustment, junior high school students, cognitive skills, peer relationships, children, high school students, psychological capital, and physical activity"

continue to mutate in the last year (2022). Therefore, these keywords can be used to predict recent frontiers of research.

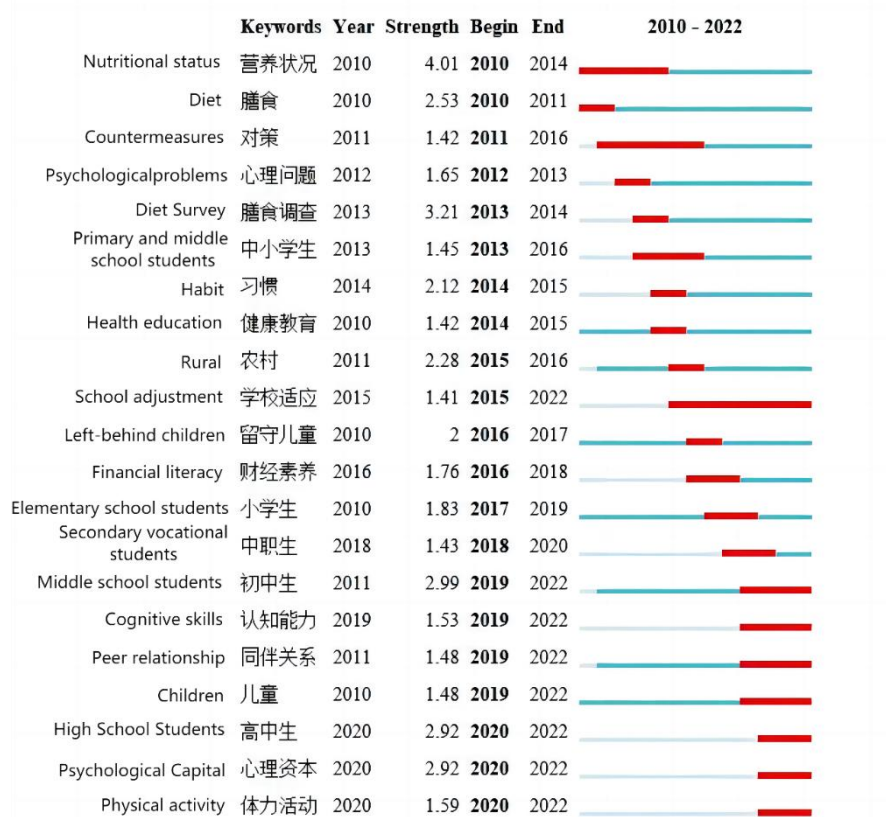**Top 21 Keywords with the Strongest Citation Bursts**

Keywords		Year	Strength	Begin	End	2010 – 2022
Nutritional status	营养状况	2010	4.01	2010	2014	
Diet	膳食	2010	2.53	2010	2011	
Countermeasures	对策	2011	1.42	2011	2016	
Psychologicalproblems	心理问题	2012	1.65	2012	2013	
Diet Survey	膳食调查	2013	3.21	2013	2014	
Primary and middle school students	中小学生	2013	1.45	2013	2016	
Habit	习惯	2014	2.12	2014	2015	
Health education	健康教育	2010	1.42	2014	2015	
Rural	农村	2011	2.28	2015	2016	
School adjustment	学校适应	2015	1.41	2015	2022	
Left-behind children	留守儿童	2010	2	2016	2017	
Financial literacy	财经素养	2016	1.76	2016	2018	
Elementary school students	小学生	2010	1.83	2017	2019	
Secondary vocational students	中职生	2018	1.43	2018	2020	
Middle school students	初中生	2011	2.99	2019	2022	
Cognitive skills	认知能力	2019	1.53	2019	2022	
Peer relationship	同伴关系	2011	1.48	2019	2022	
Children	儿童	2010	1.48	2019	2022	
High School Students	高中生	2020	2.92	2020	2022	
Psychological Capital	心理资本	2020	2.92	2020	2022	
Physical activity	体力活动	2020	1.59	2020	2022	

Figure 7 Top 21 keywords with the strongest citation bursts

Discussion

It is necessary for this study to provide an overview of the state of development and research on boarding students while analyzing important research questions. This will provide researchers with important references for understanding boarding student research in China and help them grasp the scientific developments and research issues in the field of boarding student research.

In terms of the temporal distribution of publications, the literature in this period is divided into two phases, with 2016 as the watershed year. The general trend can be summarized as rising and then falling and can be divided into two phases. The first phase is the golden period, with the number of literature studies about boarding students showing a steady growth trend from 2010 to 2016. With the implementation of the "layout adjustment" policy of Chinese schools, the development of boarding schools ushered in a golden period, and research related to boarding students received extensive attention from the academic community. However, the second phase is a period of fluctuation and decline, with a downward trend in the number of articles published in the field of boarding student research from 2017 to 2022. There is a decline in the heat of research on boarding students, and the progress of research is slow and stable. The main reason is that the construction of boarding schools has improved and stabilized, and research on boarding students is no longer the focus of society. The Chinese government has also adjusted its education development policy, and the goal has changed to one of promoting the balanced development of compulsory education and thus

the achievement of educational equity, centered on improving the standards of rural schools and weaker schools.

In terms of researchers and research institutions, this also indicates that overall, the collaborative relationships between authors are not obvious and the studies are mostly independently done. In the most obvious collaboration groups, the line of partnership is mainly concentrated in scholars such as Huo Junsheng, Pu Wei, Huang Jian, Sun Jing, and Wang Lijuan, and these authors are more connected and collaborate more closely with each other; Sun Jing (8 articles), Pu Wei (7 articles), Ma Guangsheng, Zhang Qian, Song Yingquan, Huo Junsheng, Li Jin, and Wang Lijuan (5 articles) are the top three researchers in terms of the number of articles published. Collaboration among research institutions is not strong, and most studies are independent. The largest network circle of research institutions is a complex collaborative network formed around the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention. Moreover, the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention is also the scientific institution that has published the most research papers on boarding students. Therefore, from the current state of researchers and research institutions described above, it is difficult to form a content-centered collaborative group because of the broader context of research about boarding students.

In terms of research hotspots, there are seven main areas of research for boarding students, as follows. (1) The distribution and groups of boarding students. In China, boarding schools are mainly located in rural areas of China and boarding elementary school students and boarding secondary school students are very common boarding groups. A large proportion of the boarding student population is made up of left-behind children. (2) The mental health of boarding students. Past studies have obtained corresponding findings by analyzing the current situation regarding the psychological problems of boarding students and then going to factor analysis to obtain the influencing factors. (3) Physical condition of boarding students. The contents of the study include nutritional status, sports injuries, eating habits, and health knowledge. Due to the insufficient supply capacity of the boarding school canteens, the physical condition of boarding students is concerning. (4) Social support for boarding students. The main sources are peer relationships, parent-child relationships, teacher acceptance, and family support. (5) Boarding students' school performance. This mainly includes school adjustment, academic achievement and habits. (6) Education of boarding students. The education of boarding students includes family education, social education, school education, etc. (7) The impact of the boarding environment on boarding students. In the past decade or so, the research on boarding students has become more and more sophisticated, firstly, the research content has improved, and the research has not only focused on the impact of the boarding environment on the physical condition of boarding students but also the impact of boarding on students' mental health. Secondly, the scope of the research has improved, as the study of boarding students not only examines the current situation of boarding but also includes the analysis of the causes and the discussion of countermeasures.

In terms of research trends and frontiers, from 2010 to 2015, scholars were more concerned with the dietary and nutritional conditions of boarding primary and secondary school students in rural areas, psychological problems, and corresponding countermeasures. This phase represents the golden period of boarding school development with research on boarding students in the exploratory stage, generally focusing on the problems exposed during the developmental stage of boarding schools, such as nutritional status, dietary status,

and psychological health, in order to successfully promote the construction and development of boarding schools by finding countermeasures to solve the problems. In the later stage (2016-2022), the studies focus on school adjustment, psychological capital, and cognitive ability of boarding children and secondary school students. The keywords "school adjustment, cognitive ability, peer relationships, psychological capital, and physical activity" of boarding students can be used to predict recent research frontiers.

Overall, the visual knowledge map produced by CiteSpace provides insight into the key authors and institutions, research hotspots, evolutionary advances, and research frontiers in the research area of Chinese boarding students. Thus, the above results can provide valuable information for future researchers. In addition, we used bibliometric analysis to objectively review the boarding student literature, which is a useful summary and addition to earlier research findings on boarding students.

Conclusions and Future Research
The above analysis of the research literature on boarding students reveals the following characteristics of research on boarding students in China. First, a more central network of research institutions has been formed in the research process on boarding students. This is a more complex cooperative network with the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention as the core, as well as leaders such as Sun Jing, Pu Wei, and Ma Guangsheng. Second, rural boarding students from elementary school to high school are a group of high concern in terms of keywords, clustering, and mutation. From the emergence of the group to the present, the research hotspots are education and physical health status issues, mental health, and school adjustment. Third, the frontiers of research on boarding students focus on "school adjustment, cognitive ability, peer relationships, psychological capital, and physical activity".

However, this study has several limitations. The visual analysis of this study for the field of boarding students has two main shortcomings. First, the data comes from a single source with a small sample size. The data originated from the China National Knowledge Infrastructure Database (CNKI), which mainly focuses on combing the research literature on boarding students in China without involving foreign-related studies, resulting in single data and small sample size. Second, while searching the literature, advanced searches were mainly conducted by title terms, which might have resulted in important literature being omitted.

Considering the above findings, we propose several suggestions for future research. First, multiple databases should be selected for data collection to obtain more comprehensive data. Second, literature searches for boarding students need to be conducted using multiple types of searches in conjunction with each other, and thus more comprehensive literature data can be obtained.

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