Review

International Research Review and Teaching Improvement Measures of College Students' Learning Psychology under the Background of COVID-19

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Abstract: The COVID-19 pandemic has had a significant impact on college education. College students have faced great difficulties in terms of learning and living during the lockdown period, which has brought many negative psychological effects. To explore the psychological states of college students learning during the COVID-19 pandemic and the reasons for these states, this study used CiteSpace to analyze 105 articles on WoS about college students' learning psychology, and the results of this analysis were combined with an interpretation of the literature to summarize the research hotspots, development trends, learning psychology types, and reasons in this field. The main findings were as follows: (1) During the COVID-19 pandemic, the psychological state of learning college students mainly included academic burnout, learning anxiety, and learning pressure. (2) Academic burnout was affected by perceived usefulness and self-control and was manifested as not accepting online teaching and truancy. (3) Learning anxiety was affected by emotional support factors and was manifested as loneliness, anxiety about lockdown management, and fear of infection. (4) Learning pressure was affected by perceived ease-of-use, environmental support, and self-efficacy and was manifested by difficulties completing online learning tasks, academic performance, and future career uncertainty. Given the above findings, this study proposes corresponding teaching improvement measures from the perspective of the sustainability of the teaching methods of teachers and students' continuous learning, providing teaching references for schools and teachers, and psychological support for students.

Keywords: COVID-19; college students; learning psychology; improvement measures

1. Introduction

By the end of 2019, COVID-19 was rapidly spreading around the world. On 11 March 2020, the World Health Organization increased the public health emergency rating caused by COVID-19 to an international pandemic [1]. The COVID-19 pandemic may have affected mental health through direct threats to personal health or due to the indirect impact of public health policies and containment measures, leading to psychological crises such as post-traumatic stress disorder, anxiety, and depression [2,3]. College students are initially in the transition stage of their studies and careers and are prone to experience high levels of stress, anxiety, and depression [4]. Coupled with the COVID-19 pandemic, the psychological state of college students has been dramatically impacted. Many scholars' studies during the crisis have confirmed that the COVID-19 pandemic had a huge negative impact on the psychological state of college students, which was usually manifested as anxiety, depression, and a small number of suicidal tendencies [5–7]. These mental states were a general trend. In addition, scholars have also analyzed the impact of COVID-19 on college students' mental states according to differences in personality, gender, grade, specialty, and other personal characteristics [8,9]. Students with attachment personalities [10], female students [7], low-grade students [11], and medical students [12] have received more

significant psychological pressure. Scholars have also put forward a lot of suggestions for psychological interventions, predicting the stress levels of students through neural network models, and making early prevention plans [13]. In addition, in most studies, teachers have been shown to be essential interveners in college students' psychological states during the COVID-19 pandemic. Teachers should meet students' emotional and academic needs during online teaching and consider how to minimize the negative impact on the environment and increase access to mental health resources [14]. At the same time, the support of teachers has been proven to be the most important influencing factor for the sustainability of students' learning [15]. Sustainable education should consider improving not only students' knowledge but also their psychology and behavior [16]. Sustainable learning refers to teachers' curriculum and teaching methods that can provide students with the knowledge and tricks they need to sustain their learning in different environments (such as normal or crisis environments), life transitions (such as from university to the workforce), and different fields [17]. The current research shows the psychological state of college students in the context of the COVID-19 pandemic and how various personal characteristics present different effects. Based on these studies, this paper analyzes the state of college students' learning psychology from the perspective of learning. Further, it explores the types and causes of learning psychology that affected students' continuous learning during the COVID-19 crisis.

To stop the spread of the COVID-19 pandemic to campuses, universities conducted centralized medical isolation for infected students and students in close contact and led campus lockdowns, online teaching, and other activities according to the pandemic situation in their region. This series of behaviors and measures significantly changed students' lifestyles and learning modes. They needed to adapt to an unfamiliar e-learning environment [18], receive unsuitable electronic education technology [19], they could not participate in regular social activities [20], and they continued to worry and panic about the spread of the pandemic [21]. These changes in learning style and living habits caused by COVID-19 have seriously affected their mental health and thus jeopardized the effectiveness of their learning [22]. Therefore, it is necessary to explore the influence and influencing factors of college students' psychological states in terms of learning under the background of the COVID-19 pandemic and put forward improvement measures for teachers and students from the perspective of teaching and learning, which has important guiding significance for improving teaching in the post-pandemic era, stabilizing the learning psychology of college students, and promoting the sustainable development of education in the post-pandemic era.

2. Research Methods and Data Processing

2.1. Research Methods

In this study, CiteSpace 6.1 was used for the visual analysis of the collected data. CiteSpace is a bibliometric analysis software developed by Professor Chen Chaomei's team and is based on the Java language environment. Its advantage is that it can analyze the co-occurrence, prominence, and clustering of authors, institutions, and keywords in a research field and present them in a visual knowledge map. It is helpful for researchers to quickly understand a research situation and deeply mine text data information [23–25].

2.2. Data Processing

The data for this study was sourced from the Web of Science, where a core collection database was selected, including three databases: the extended science citation index (SCIE), the social science citation index (SSCI), and the emerging source citation index (ESCI). First, according to the research topic of this article, this paper selected the keywords "COVID-19", "student", and "psychology". Second, we searched the three keywords separately. When searching for each keyword, we selected the literature type as "Article" and the language as "English" to obtain the research literature on each of these three keywords. Third, in WoS advanced search, the three keywords were combined and retrieved, resulting in 266 articles containing the three keywords simultaneously. Fourth, we screened the topics of these

266 articles, selected and analyzed articles related to the learning psychology of college students, and exported the documents that met the topics in a plain text file format and stored them in a data processing folder. Finally, importing CiteSpace to delete duplicate data resulted in 105 valid articles.

3. Bibliometric Results

3.1. Number of Publications, Research Countries, and Institutions

Through the article retrieval, there were 266 articles about students' psychological analysis during the COVID-19 pandemic and 105 articles about college students' learning psychology analyzed through a screening analysis. Figure 1 shows the number of articles that included an analysis of students' psychology published from 2020 to February 2023 and the number of articles that included an analysis of college students' learning psychology, as well as proportion of the two. COVID-19 broke out at the end of 2019, so in 2020, the psychological state of students was only a preliminary concern, and there was a great increase in 2021 and 2022. In the past four years, articles related to the analysis of the learning psychology of college students each year accounted for about one third of the total articles related to students' psychological analysis, which to some extent shows that the learning psychology of college students was the focus of educational scholars during this period.
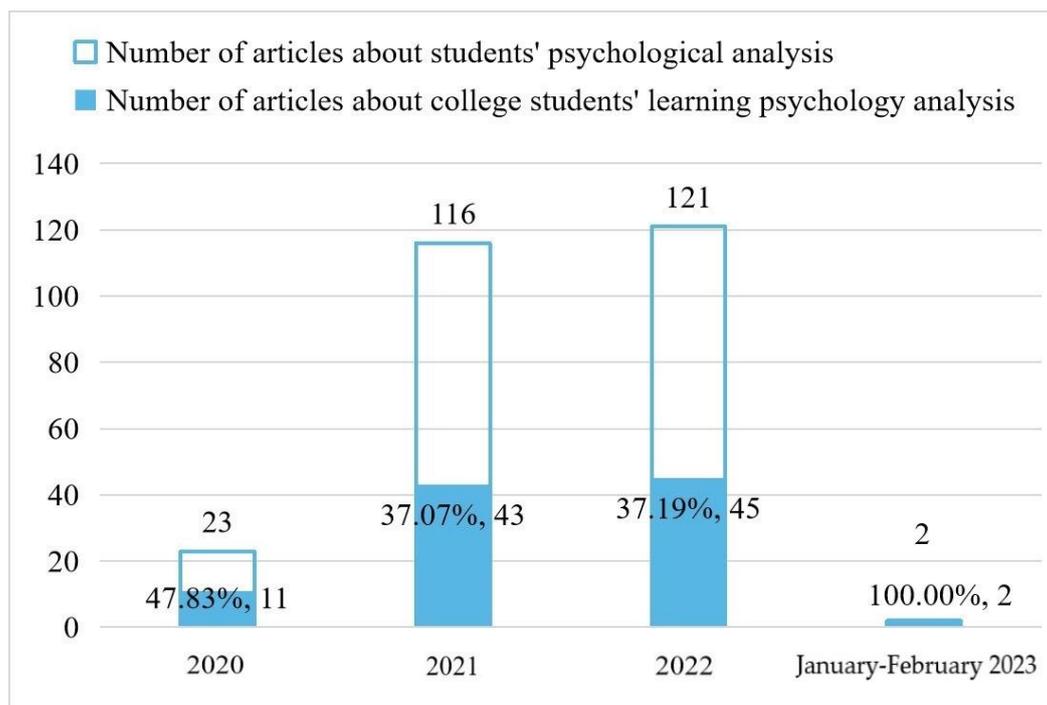

Figure 1. Number of articles published.

As shown in Figures 2 and 3, cooperative network diagrams of countries and institutions that have studied the learning psychology of college students were generated using CiteSpace. Table 1 lists the top three countries that have published research on the learning psychology of college students, the top two institutions that have published research in this field, and their centrality. Since there were ten institutions with two publications, only the research institutions with a number of publications in the top two were counted here. It can be seen from Table 1 that the two countries with the largest number of publications were China (26.67%) and the United States (19.05%). The centrality values of the top three countries exceeded 0.1 and were also the highest, indicating that these three nodes were central nodes and that these three countries were more important and had a more significant

influence in this field. From the perspective of research institutions, there were 82 research institutions in total, of which the University of Granada had the most significant number of publications, i.e., a total of three. In addition, the number of publications by the following ten institutions was two, and the number of publications by the remaining 71 institutions was one. The number of publications by each institution was similar. The centrality of all institutions was calculated as 0, indicating a lack of contact and cooperation between these institutions. The COVID-19 pandemic severely restricted international education exchanges and inhibited the sustainable development of international education. However, colleges and universities around the world can learn from the information and communication technology widely used in the pandemic, carry out international long-distance online classes, academic seminars, and other exchange activities, and cooperate with colleges and universities around the world to carry out scientific research projects, improve students' abilities to compete and cooperate internationally and promote the common development and sustainable development of global education.
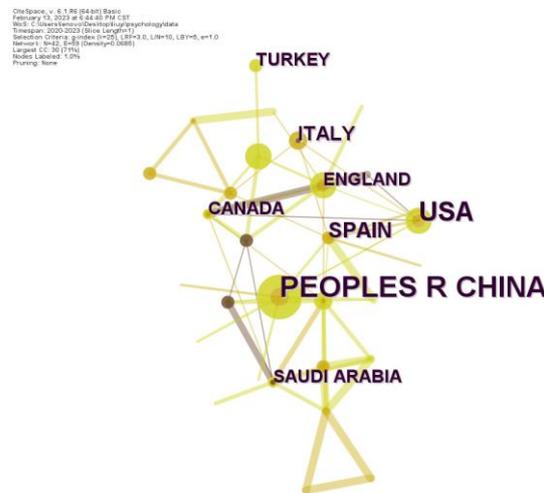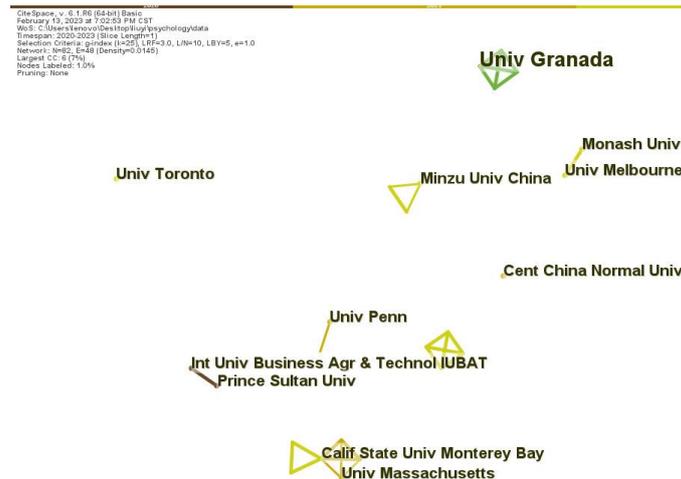

Figure 2. Collaboration network of research countries.

Figure 3. Collaboration network of research institutions.

Table 1. Number of publications and centrality of research countries and research institutions.

Rank	Country	Number	Centrality
1	China	28	0.22
2	USA	20	0.11
3	Spain	9	0.19

Rank	Institution	Number	Centrality
1	University of Granada	3	0
	University of Melbourne	2	0
	University of Massachusetts	2	0
	Prince Sultan University	2	0
	IUBAT—International University of Business Agriculture and Technology	2	0
2	Monash University	2	0
	University Toronto	2	0
	Central China Normal University	2	0
	University of Pennsylvania	2	0
	California State University Monterey Bay	2	0
	Minzu University of China	2	0

3.2. Keyword Co-Occurrence and Burst Words

3.2.1. Keyword Co-Occurrence

Keywords usually reflect the focus and theme of an article, and the frequency of keywords in the literature in a specific field reflects the hot topics that researchers pay attention to in a certain period. CiteSpace was used to analyze the keywords of the literature regarding college students' learning psychology in the context of the COVID-19 pandemic. The keywords co-occurrence diagram of the literature regarding college students' learning psychology shown in Figure 4 was obtained. In Figure 4, a node is a keyword. There were 140 keywords in 105 articles about the psychological analysis of college students' learning collected during this time. The larger the node's size, the more frequently the keyword appeared. The higher the frequency of the keyword, the more popular the keyword was. When two keywords appeared in one study simultaneously, there was a connection. The centrality reflects a node's link role and its importance in the network. The higher the centrality value, the more keywords that were associated with it, and the more significant the link role, and the higher its importance. The top ten keywords of WoS's research on college students' learning psychology in the context of the COVID-19 pandemic are listed in Table 2, and these were obtained according to the data statistics in CiteSpace and those shown in Figure 4. Among them, two keywords with sixteen frequencies were in second place, five keywords with a frequency of eight were all in ninth place; and three keywords with a frequency of seven were all in tenth place.

According to Table 2, the most frequent keyword was mental health, which was consistent with the research field selected in the article. When scholars study the learning psychology of college students in the context of the COVID-19 pandemic, they mainly focus on the negative learning psychology of stress, anxiety, and depression [3,26,27]. Secondly, students' learning psychology from the perspective of positive psychology is usually adjusted [28,29]. The relationship between these psychological states and learning performance is also discussed [30,31].
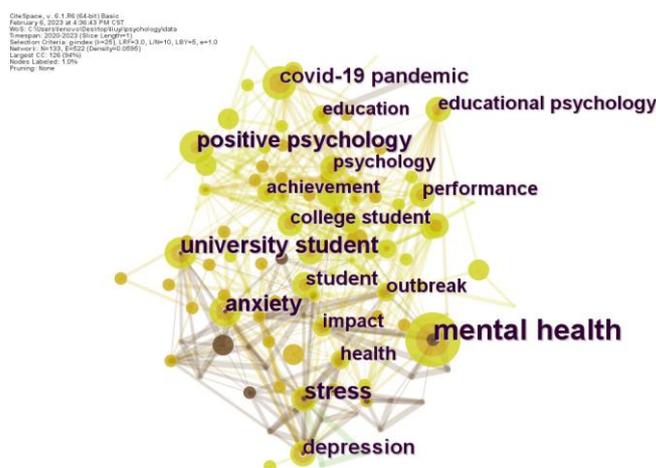
Figure 4. Keyword co-occurrence network.

Table 2. Top 10 keywords and their centrality.

Rank	Keyword	Frequency	Centrality
1	mental health	35	0.15
2	university student	16	0.12
	stress	16	0.17
3	anxiety	14	0.07
4	positive psychology	13	0.01
5	depression	12	0.09
6	COVID-19 pandemic	11	0.02
7	student	10	0.04
8	outbreak	9	0.03
9	health	8	0.14
	educational psychology	8	0.06
	college student	8	0.07
	impact	8	0.05
	performance	8	0.05
10	achievement	7	0.04
	education	7	0.12
	psychology	7	0.05

3.2.2. Burst Words

Burst keywords are mainly used to detect the research hotspots and heat of a specific research field in different periods. Mastering burst words plays a vital role in revealing research trends. The higher the intensity of burst words, the higher the level of attention of scholars paid to this keyword in this field. The first eleven burst words with the highest intensity were obtained through burst word detection, as shown in Figure 5. Keywords indicates the burst keywords used in this study, and Year indicates the year when the keyword first appeared. Strength indicates the strength of the burstiness, Begin and End indicate the time of the beginning and end of the emergence, and the bold red line is the duration of the emergence. According to Figure 5, the psychological state of college students received continuous attention at the beginning of the COVID-19 pandemic, but the focus of the attention was different at each stage. The earliest keyword with the strongest burst intensity was "mental health care", but this keyword did not receive much attention after

2020. At present, "academic performance" received the greatest attention, which indicates that the study of college students' learning psychology in the context of the COVID-19 pandemic changed from an initial focus on mental health to academic performance. Scholars now pay more attention to improving the effectiveness of the learning of college students by analyzing their learning psychology to ensure the sustainable and high-quality development of education in various regions under the influence of COVID-19 [32,33].

Top 11 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2020 - 2023
mental health care	2020	1.73	**2020**	2020	
validity	2020	1.15	**2020**	2020	
clinical psychology	2020	1.15	**2020**	2020	
psychometric property	2020	0.91	**2020**	2020	
psychological distress	2020	0.91	**2020**	2020	
academic performance	2022	1.14	**2022**	2023	
personality trait	2022	0.85	**2022**	2023	
efficacy	2022	0.85	**2022**	2023	
online education	2022	0.85	**2022**	2023	
intervention	2022	0.85	**2022**	2023	
fit index	2022	0.85	**2022**	2023	

Figure 5. Top 11 keywords with the highest burst.

3.3. Clustering Results

To explore the profound relationship between the research topics of these articles, this paper used the clustering function of CiteSpace for the clustering analysis. Citespace provides three algorithms: LSI, LLR, and MI. During the running process, it was found that the results obtained by using the LLR algorithm were better and more in line with the actual situation. Therefore, the algorithm used in this clustering was LLR. Citespace provides three tag sources for extracting cluster tags: title, keywords, and abstract. According to the actual needs and comparative analysis, it was found that the cluster tags extracted from the title were more in line with the research needs, which indicated the research theme and direction of the learning psychology of college students. The clustering results are shown in Figure 6. The modular degree of Q = 0.6199 in the clustering results was much higher than 0.3. The clustering modularity value (Q value) generally holds that a value of Q > 0.3 means that the clustering structure is significant. The Silhouette = 0.8559, which was higher than 0.7. The average S value of clustering generally holds that a value of S > 0.5 means that the clustering is reasonable, and S > 0.7 means that the clustering is convincing. So, the structure of this cluster was significant and convincing. A total of twelve clusters were formed this time, but only seven clusters were valid. The criterion for effective clustering is that the number of cluster members is greater than ten, and the S value is greater than 0.7. An S value > 0.7 indicates that the cluster members have good internal compactness, the inner members are similar, and the cluster is convincing. The seven effective clusters were #0 COVID-19 campus closure, #1 strengths psychological stress, #2online learning, #3 self-efficacy subjective well-being, #4quantitative study, #5 academic burnout, and #6 university student. The clustering order starts from 0. The smaller the number, the more members in the cluster. Each cluster was composed of multiple closely related words.
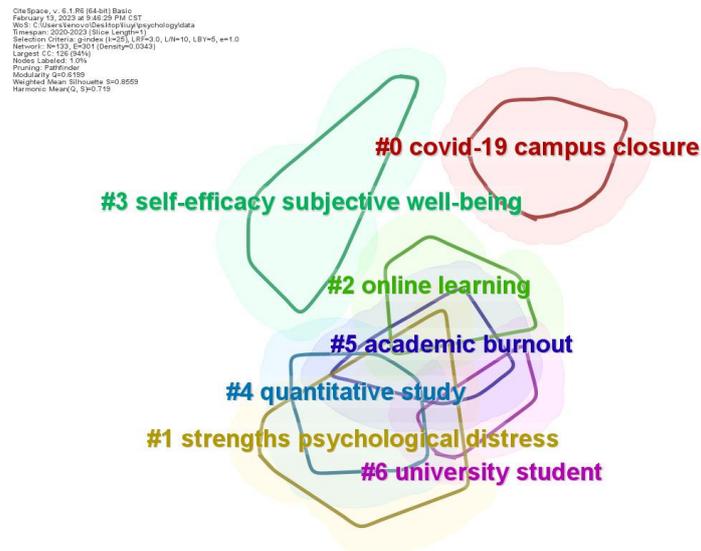
Figure 6. Cluster analysis results.

Through an in-depth analysis of the members in the cluster based on an interpretation of the literature, it was found that COVID-19 harmed the psychological state of college students in terms of learning, and this was mainly divided into three aspects: academic burnout, learning anxiety, and learning pressure. The specific performance of these learning psychologies was different. A further summary is shown in Table 3.

Table 3. The types, specific performance, and influencing factors of learning psychology.

Learning Psychology	Specific Performance	Influencing Factor
Academic burnout	Not accepting online teaching [34,35].	Perceived usefulness
	Truancy and cannot concentrate on online classes [36].	Self-control
Learning anxiety	Feeling lonely and lacking social participation [11,37].	Emotional support
	Concern and fear of lockdown and infection [12,38].	
Learning pressure	Not familiar with online learning and more difficult to complete tasks [14].	Perceived ease-of-use
	Internet access and quiet learning places are limited and the responsibility to take care of family is greater [10,14].	Environmental support
	Uncertainly related to academic performance and future career prospects [39].	Self-efficacy

Academic burnout was specifically manifested in two aspects. First, college students were psychologically unwilling to accept online learning, resulting in burnout. The main reason was that compared with traditional teaching, online learning lacks direct communication, and the learning atmosphere cannot meet the basic psychological needs of students [40,41], and thus students cannot achieve an ideal learning efficacy [41,42]. Some students whose online learning conditions were limited due to family difficulties or underdeveloped communication in their area needed help to complete online learning and examinations [43]. Some students with strong professional practicality could only study normally with laboratory conditions. For these students, online education had no effect or was not helpful [44]. Second, due to the difficulties in online classroom supervision, some students with weak self-control put online classrooms aside, did other things, or even skipped classes [45]. Over time, it caused them to develop a sense of fatigue towards their studies, resulting in sustained negative learning performance.

A specific manifestation of learning anxiety is that students felt lonely and unable to participate in normal social activities due to lockdowns or centralized isolation. Secondly, as the pandemic situation in the area where the colleges and universities were located became more serious, students worried more about whether the campus would closed or were afraid of being infected with COVID-19, so they could not normally engage in learning. In addition, anxiety is one of the main factors or obstacles that affect the learning process [46]. Repeated mutations of COVID-19 can cause repeated infection, and anxiety about health and the social economy can bring continuous learning anxiety to students.

Learning pressure was embodied in three aspects. First, in the early stage of the pandemic outbreak, offline teaching was fully converted to online education due to the sudden incidence of the pandemic. For some students with low computer literacy, it took a long time for them to adapt and become familiar with online learning systems, which added additional pressure onto the students with weak learning abilities and made it more challenging to complete learning tasks [46]. Second, whether the students were locked down at home or in a dormitory, their environment was not a suitable place for learning. Parents, siblings, and roommates brought some interference factors [47]. Third, COVID-19 and the future uncertainty caused by the lockdown were major sources of pressure for college students. Once isolated, students about to graduate were not able to carry out normal job-hunting activities, and recruiters outside the campus could not enter the campus for promoting their businesses. Under such uncertain circumstances, students' self-efficacy and achievements would not be reflected, and they would feel greater pressure when the school transitions back to normality.

4. Conclusions and Improvement Measures

4.1. Conclusions

This paper used CiteSpace to visually analyze the psychological state of college students in the context of COVID-19. It combined the visual analysis results and an interpretation of the literature to draw the following conclusions:

(1) The learning psychology of college students in the context of COVID-19 is an area that educators have focused on, especially Chinese and American scholars. However, research institutions in this field lacked cooperation and were not closely connected.

(2) Research hotspots in this field mainly have focused on mental health, positive psychology, and negative learning psychological states such as stress, anxiety, and depression. The research trend has shifted from focusing on mental health to improving academic performance.

(3) Under the background of COVID-19, college students' learning psychology was divided into three aspects: academic burnout, learning anxiety, and learning pressure.

(4) Academic burnout was affected by perceived usefulness and self-control, manifested as not accepting online teaching, truancy, and an inability to concentrate on online classes.

(5) Learning anxiety was affected by emotional support factors, specifically manifested as loneliness, a lack of social participation, and the fear of lockdowns and infection.

(6) Learning pressure was affected by perceived ease-of-use, environmental support, and self-efficacy. It was manifested explicitly as unfamiliarity with online teaching and more difficulty in completing tasks, internet access and quiet learning places being limited, the responsibility to take care of family being greater, and uncertainty related to academic performance and future career prospects.

4.2. Improvement Measures

COVID-19 has had a negative impact on sustainable education learning. Teachers must transition from traditional classroom teaching to innovative and flexible learning methods to improve learners' achievements and participation [48]. Based on the United Nations Sustainable Development Goal 4, "Achieving inclusive and high-quality education for all," and the above research conclusions, this paper, from the perspective of teachers' sustainable

teaching and students' continuous learning, combined the specific manifestations of the three learning psychologies and proposed improvement measures to improve the three learning psychological states of college students in the context of the COVID-19 pandemic and promote the sustainable development of classroom teaching in the post-pandemic era.

4.2.1. Improvement Measures for Academic Burnout

(1) **Flexibly arrange the content and form of online teaching, refine student categories, and enrich personalized teaching.** Online education has a low sense of presence, and there is a lack of direct emotional communication between students and teachers. There is also a lack of opportunities for thinking collision between students and teachers, and psychological needs cannot be met. Therefore, the content and form of online teaching should be different from traditional classrooms. Teachers should change from "controllers" to "guides", and students should change from "passive receivers" to "active explorers" to enhance their sense of presence in online learning. Before class, teachers can ask students to discuss and think about the relevant cases or current events in groups. During class, each group can report the data collected and discuss results, and teachers can introduce the course according to the report. After teaching basic knowledge, some questions could be set to encourage students to share new insights and cognition. The results of these classroom discussions can be taken as part of the course assessment results, and students can be allowed to accept online teaching faster and acquire knowledge through online teaching in the way of active learning. For some students with limited online learning capabilities, teachers should fully understand their difficulties and let them participate in learning in other ways. For example, books related to the course can be recommend to them and they could be allowed to learn actively in the form of course reports. An online teaching scheme could be selected according to local conditions, and a teaching mode could be selected that combines recording and broadcasting according to students' needs. During the COVID-19 period, when students cannot access libraries to obtain paper-based learning materials, they could use smartphones, laptops, tablets, and other portable electronic devices to obtain electronic textbooks for learning so that they can constantly learn at any time and anywhere [49], which is also in line with the goal of sustainable learning, which is to impart learning strategies that are useful for all contents, anywhere, at any time [17].

(2) **Build real-time feedback mechanisms in the classroom, sign in regularly, and strengthen communication with students.** In offline classes, teachers can constantly monitor students' statuses, but students are often unwilling to actively participate in classroom interaction because of fear of making mistakes in public. With a screen barrier, teachers can encourage students to speak more online, and this is not limited to using a microphone to speak. Online feedback can use text, pictures, expression packs, etc., to allow students to express their views in real-time in the chat window, enhance the interaction between students and teachers, and provide the entertainment of the classroom so that they can relax and learn more and concentrate on the classroom. Of course, some rigid supervision and management measures are also necessary. Teachers can sign in any time to check whether students are doing other activities. Teachers can call the names of some students who have not interacted for a long time and interact with them to confirm whether they are present.

4.2.2. Improvement Measures for Learning Anxiety

(1) **Build psychological help groups, strengthen psychological communication with students, and conduct more online entertainment activities.** Teachers and student cadres can set up psychological support groups to actively care about the psychological status of students in centralized isolation or in lockdowns and provide emotional support and material assistance. Isolated students communicate with the outside world more in online classes or activities. To relieve the psychological pressure on

students, teachers can communicate with students before the course starts, solve problems and difficulties, talk about their problems or pressures, and respond promptly to find solutions to problems and relieve stress. In addition, online extracurricular activities with positive themes can be organized, such as online question-answering activities, online speech activities, pandemic prevention knowledge competitions, and knowledge seminars. Students could be allowed relieve their loneliness through participation in activities and large-scale online interpersonal communication, find optimism and hope in an unusual time, and meet their normal social needs.

(2) **Correctly guide students to obtain information about the pandemic, appease and stabilize students' emotions in a timely manner, and actively respond.** Nowadays, the online environment is complex, and students have many sources of information. Some false pandemic information can easily cause large panic in student communities. Teachers should guide students to pay attention to and use the official platforms of their country, schools, and colleges and ensure that the official media occupies the central information-giving position. The latest pandemic prevention and control knowledge, important school notice arrangements, and other information should be publicized through official platforms. In the case of an epidemic in the school's area, it is necessary to stand up in time to stabilize students' emotions and ensure that the students' material needs are met. For some special situations, it is essential to have targeted and humanized solutions and respond in time to give students enough of a sense of security.

4.2.3. Improvement Measures for Learning Pressure

(1) **Teachers should strengthen communication with students, understand students' living conditions, and jointly create a good online learning environment.** During the pandemic, home-based isolation's heavy and uneasy atmosphere turned the family into a battlefield of contradictions. The interference of parents, brothers, and sisters could also bring tremendous pressure on students' studies. During the pandemic, teachers should strengthen communication with students, understand the problems they encounter in their studies and life, and provide personalized psychological pressure assistance to students. In addition, parents should be communicated with to ensure that students have a good learning environment, and parents should be urged to supervise and help.

(2) **Organize training and build a multi-dimensional online learning assessment mechanism.** Schools started online teaching suddenly after the outbreak of the pandemic. It is necessary to improve the information literacy level of teachers and some students who have not engaged with online learning platforms before college. Teachers should help them understand how to complete exams and submit assignments online, how to review teaching through the online teaching platform, and provide corresponding technical support when they encounter problems. Online teaching cannot be assessed by only one test paper. For some students with limited online learning capabilities, even if they still pass online examinations, this will bring great pressure to their learning. It is necessary to develop an assessment mechanism that conforms to the characteristics of online teaching and carry out targeted assessments according to the situation of students. In addition to homework after class and final examinations, it is also possible to add a variety of assessment methods, such as classroom discussions, course reports, experiment reports, etc. The assessment of online teaching should not only look at results but also measure how much knowledge students have gained through online learning.

(3) **Guide students during graduation to clarify their career development direction.** According to the national policy, teachers can provide corresponding help for students during each graduation season. First, for students who need to take a postgraduate entrance examination, students could be encouraged to participate in the postgraduate entrance examination, etc., and the channels for further study could be broad-

ened. For example, a learning mutual aid group could be created to share learning experiences and relieve learning pressure through regular discussion. Second, for students with employment and entrepreneurship plans, alums who have successfully started businesses or companies with recruitment plans could be invited to hold online experience-sharing meetings or online job fairs to help students to find their orientation in the graduation season.

5. Contribution and Future Research Direction

According to the visualization results, discussion, and analysis above, this paper established a knowledge analysis framework of college students' learning psychology in the context of the COVID-19 pandemic, as shown in Figure 7, which provides some valuable references for future research in this field.
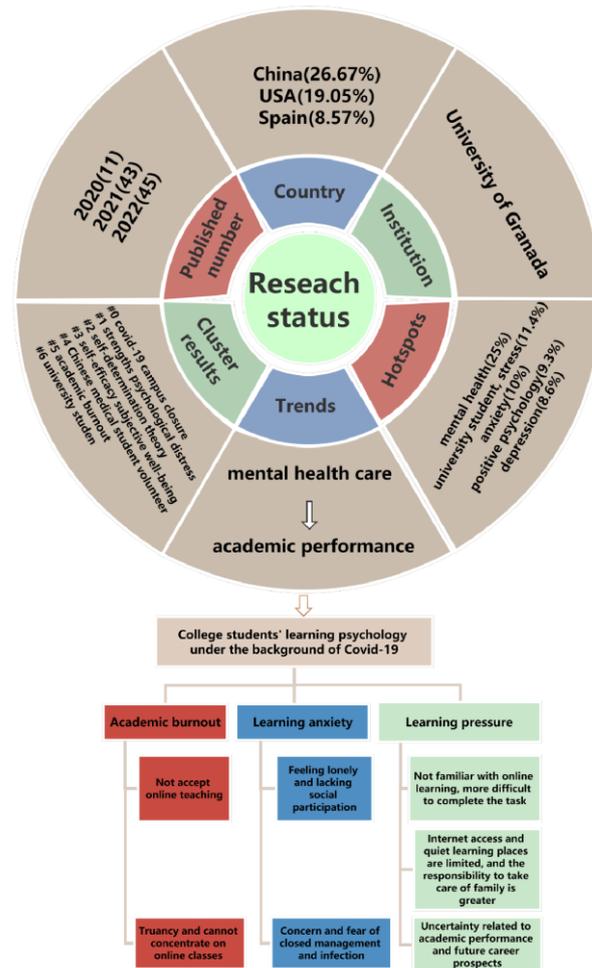

Figure 7. Knowledge analysis framework.

The knowledge framework diagram briefly describes the research ideas of this paper. This diagram also contributes to the knowledge in the field of learning psychology research for college students, from which readers can quickly obtain this article's research results and conclusions. First, CiteSpace was used to comment on the research on the learning psychology of college students in the context of COVID-19. Figure 7 mainly lists the number of publications from 2020 to 2022, the three countries with the largest number of contributions, and the institutions with the largest number of publications. In addition, it lists the top five keywords that appeared most frequently, the research trends, and the seven clusters formed so that readers can quickly grasp the research situation in this field. Another key part of this article is that it combined the research review results with an

interpretation of the literature to summarize three learning psychologies and their specific manifestations in college students in the context of the COVID-19 pandemic.

5.1. Contribution

The research contribution of this paper is that it was the first to use a method that combines the function of CiteSpace cluster analysis and an interpretation of the literature to classify and summarize the types, specific manifestations, and reasons for the different learning psychologies of college students in the context of the COVID-19 pandemic, and finally, from the perspective of teachers and students, to put forward sustainable improvement measures to provide a reference for schools and teachers to improve their teaching in the post-pandemic era, as well as providing psychological counseling for college students.

5.2. Future Research Direction

Some areas could be improved in this study. Since the outbreak of COVID-19, there has not been a lot of relevant research in the literature for three years, and only 105 effective articles were collected in this study. In future research, scholars could expand the sources of the data. In addition to the literature, they could also analyze some psychological survey reports, psychological statistics, or first-hand materials that can reflect online learning psychology and use text data analysis methods, such as the qualitative data management software NVivo, to explore some potential learning psychological states and the causes of these psychological states [50]. For scholars in the field of college students' learning psychology in the context of COVID-19, in addition to the traditional questionnaire survey method, psychological experiments could also be used to evaluate the effectiveness of a positive psychological intervention [6,51]. In addition to students, teachers' psychological distress in the context of the COVID-19 pandemic is also a topic worthy of attention [52,53].

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