ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

Current Status, Hot Spots and Future Prospects of Non-Cognitive Ability Research Based on CiteSpace Visual Comparative Analysis

Jiaqi Li

School of Finance and Public Administration, Anhui University of Finance and Economics, Bengbu, 233030, China

Abstract: *With the help of CiteSpace, the relevant literature in CNKI and Web of Science was visually analyzed, and the current status and hot spots of non-cognitive ability research at home and abroad from 1964 to 2022 were understood through the knowledge graph, and the comparative analysis was carried out accordingly. The results showed that the research on non-cognitive ability at home and abroad had commonality in the development trend and the degree of cooperation between institutions and authors, but there were differences in research hotspots, stage frontiers and discipline diversification. In the future, China's non-cognitive ability research should pay attention to international exchanges and cooperation, and strengthen the subdivision and innovation of empirical research.*

Keywords: *Non-cognitive ability; Non-cognitive skills; Non-cognitive factors; CiteSpace*

1. Introduction

Non-cognitive ability refers to individual characteristics other than cognitive ability that cannot be directly measured by level tests, such as: personality, preferences, social adaptability, emotional intelligence, etc. Studies have shown that non-cognitive abilities are important for individual educational achievement, labor market gains, and cognitive improvement [1]. Due to the huge number of achievements in this field and the rich and complex content of the literature, it is impossible to objectively show the changes and development trends of research hotspots in this field at home and abroad through periodic summary and traditional paper analysis, let alone compare the differences between domestic and foreign non-cognitive ability research results.

Therefore, this paper uses CiteSpace 6.1 R2 metrology software to quantitatively and qualitatively analyze the non-cognitive ability related literature published at home and abroad in CNKI (hereinafter referred to as CNKI) and Web of Science (hereinafter referred to as WOS) in the past 30 years, so as to show the progress and trajectory of non-cognitive ability research at home and abroad, and learn from foreign research results and experience on the basis of comparative analysis, in order to better promote the research and practice of domestic non-cognitive ability.

2. Research methods and data processing

2.1. Research methods

CiteSpace is a visual analysis software designed and developed by Professor Chaomei Chen based on Java computer language, through which a scientific knowledge map can be obtained, showing the development trend and trend of a discipline or field in a certain period, and then finding out the relationship between the information in the literature, helping to analyze the development context of the discipline, identifying the knowledge base of the discipline, detecting research hotspots and key points and predicting future research trends.

2.2. Data sources and processing

The search method of domestic literature was CNKI as the data source: TS="non-cognitive ability"OR"non-cognitive skills"OR"OR", "non-cognitive factors", the search time was October 15, 2022, and the number of articles obtained for the first time was 517. After screening the irrelevant literature

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

one by one, 510 valid literature were finally obtained. The search of foreign literature was based on the WOS core collection as the data source. The theme was set to "non-cognitive ability"OR"non-cognitive skills"OR", "non-cognitive factors", and 1335 articles were obtained. Taking "Article" and "English" as the refining basis, irrelevant documents and duplicate documents were eliminated, and 1025 valid documents were obtained.

3. The analysis of the research status of non-cognitive ability at home and abroad

3.1. Publication trend analysis

In order to grasp the changes in the number and timing of non-cognitive ability research literature at home and abroad as a whole, this paper summarizes the relevant literature at home and abroad (Figure 1). According to the growth and change of the number of literature, the trend of non-cognitive ability publication at home and abroad can be roughly divided into three stages:

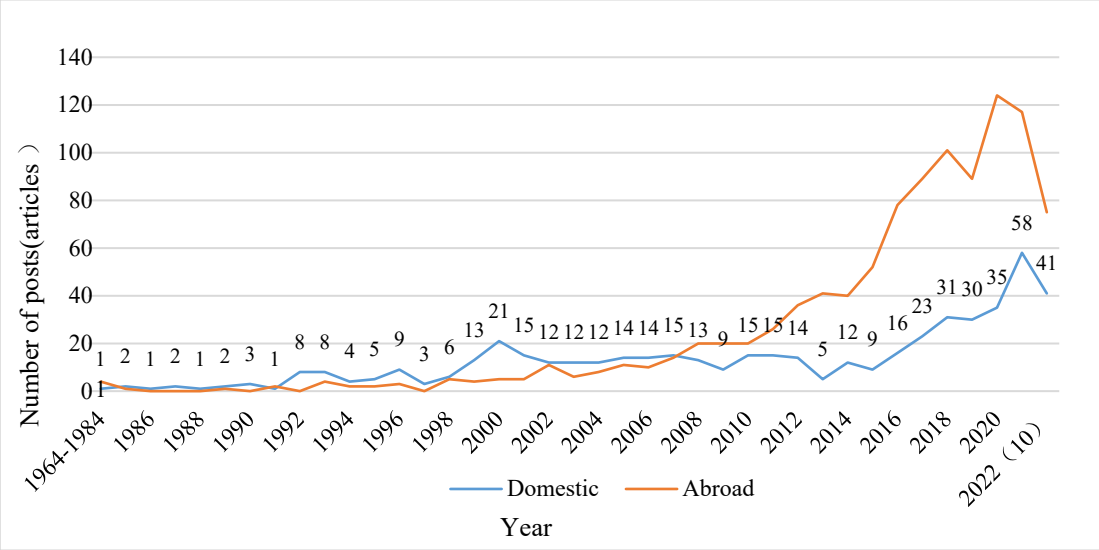

Figure 1: Annual publication trend of non-cognitive ability research at home and abroad

First, the embryonic period (1964-1998). Through the CiteSpace software, WOS data shows that the earliest relevant literature in foreign countries appeared in 1964, which was "Cognitive and Non-cognitive Aspects of Reading-ability" published by Liberty, PG in Psychological Record [2]. The initial exploration of domestic scholars was in 1984, when scholar Zhu Zhixian proposed in "Several Basic Issues on the Study of the Psychology of Thinking" that when studying the cultivation of children's thinking ability, special attention should be paid to the role of non-cognitive factors such as attention, motivation, interest, emotion, will, personality and so on [3]. During this period, non-cognitive ability-related research did not attract the attention of academic circles at home and abroad, and the number of relevant literature publications was small, and the average annual number of papers published was less than 10 articles per year.

Second, a period of stable development (1999-2015). During this period, the number of relevant foreign research literature was slow and stable, showing a fluctuating upward trend. In domestic research, 2000 showed a small peak in publications, with a total of 21 articles published annually. This is due to the Third National Seminar on Education Work held in 1999, which issued the Decision of the CPC Central Committee and the State Council on Deepening Educational Reform and Comprehensively Promoting Quality Education, which further explained the importance of comprehensively promoting quality education. Under the guidance of national policies, the development of individual comprehensive quality and multi-dimensional ability has become a hot topic. During this period, non-cognitive ability has gradually attracted the attention of scholars at home and abroad, but at this time, a stable research group has not been formed, and the trend of publishing papers is relatively flat. Among them, the average annual publication volume of domestic articles is about 13.5 articles per year, and the average annual publication volume of foreign articles is about 20.6 articles per year.

Third, a period of rapid development (2016 to present). During this period, the research on non-cognitive ability at home and abroad continued to grow rapidly, and the number of articles published

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

increased steadily, with an average annual publication volume of about 33.4 articles per year at home and abroad, and an average annual publication volume of about 96.1 articles per year at home and abroad. With the development of modern psychological measurement technology, non-cognitive characteristics such as personality, social emotions, and psychology, which were latent and difficult to measure in the past, can be accurately and intuitively displayed through more advanced scales, making it possible to study non-cognitive abilities by economic methods, which stimulates the enthusiasm of different academic circles for non-cognitive abilities other than traditional cognitive abilities[4].

3.2. Research Institute Analysis

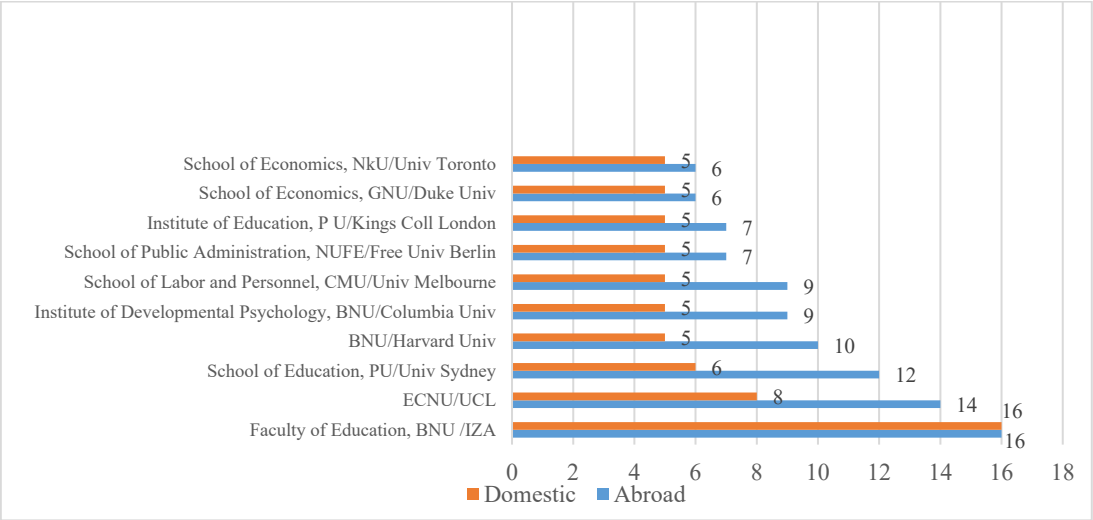

Figure 2: Statistical chart of non-cognitive ability research institutions at home and abroad (top 10)

In terms of the total number of articles, the institution with the largest number of domestic publications is the Faculty of Education of Beijing Normal University, with 16 articles, the first year was in 2012, with an average annual publication volume of 1.6; the institution with the highest number of foreign publications was IZA (German Institute for Labor Economics), with 16 articles, and the first year was in 2011, with an average annual publication volume of 1.45.From the perspective of cooperation density, the cooperation between Beijing Normal University and universities and research institutes in China constitutes the skeleton of China's non-cognitive ability research cooperation network. However, the cooperation between domestic research institutions is less and relatively scattered, and some universities show the status of independent research; The cooperation between foreign research institutions is relatively close, among which IZA (German Institute of Labor Economics), UCL (University College London), Univ Sydney (University of Sydney, Australia) and other research institutions are important nodes connecting foreign scientific research institutions and universities.

3.3. Study author analysis

Run the Cite space software, select Node Types as "Author", import the non-cognitive ability research data from CNKI and WOS databases respectively, and select the top 10 authors in terms of domestic and foreign publications, and summarize them into Table 1.

Researchers are the main body that promotes the development of disciplines, and core authors refer to the collection of authors who publish more articles and have greater influence in a discipline. The core author group refers to those authors who have a large number of articles and have a greater impact. The emergence of core authors and even core author groups can reflect the research enthusiasm and research maturity in this field. This paper uses Price's law to calculate the minimum number of publications for core authors in the field, and authors who exceed the minimum number of publications are core authors in the field namely.

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

Table 1: Statistics of core authors at home and abroad (top 10)

Ordinal	Author	Year of first publication	Number of publications	Author	Year of first publication	Number of publications
1	Zhou Jin yan	2015	5	Fletcher, JM	2016	4
2	Lin Chong de	1986	4	Lee, J	2017	4
3	Li Xiao man	2012	4	Antipkina, I	2017	3
4	Wang Chun chao	2018	4	Wolfer, D	1998	3
5	Fang Chen chen	2018	4	Liu, H	2002	3
6	Du Ping	2012	4	Lipp, HP	1998	3
7	Song Ying quan	2019	3	Wanx, XH	2020	3
8	Zhang Chuan xiao	1997	3	Peter, F	2016	3
9	Zheng Lei	2018	3	Li, H	2021	3
10	Luo Chu xin	2014	3	Bore, M	2012	2

$$N_0 = 0.749 \times \sqrt{N\max} \tag{1}$$

Where N_0 is the minimum number of posts by core authors in the field, and Nmax is the highest number of publications. As shown in Table 1, the author with the highest number of publications in China is Zhou Jinyan, with 5 articles, and the publications of other authors are roughly equal. Substituting into equation (1), i.e $N_0 = 0.749 \times \sqrt{5} \approx 2$. Therefore, authors with 2 or more articles are the core authors in this field in China. At the same time, the law also believes that a core author group can only be formed when the total number of posts by core authors accounts for 50% of the total number of posts. According to the search results, 42 core authors published a total of 98 papers in this field, accounting for 19% (less than 50%) of the total literature. Therefore, domestic non-cognitive ability research has not yet formed a stable core author group. The results of this search show (Table 1), the author with the highest number of foreign publications is Fletcher, JM, with 4 articles. Substituting formula (1), $N_0 = 0.749 \times \sqrt{4} \approx 2$. That is, those who have published 2 or more articles are core authors in the field abroad. A total of 63 core authors were counted this time, and a total of 139 articles were published, accounting for 13.6% (less than 50%) of the total literature. Therefore, foreign non-cognitive ability research has not yet formed a stable core author group.

4. Comparative analysis of non-cognitive ability research hotspots at home and abroad

4.1. Keyword comparison analysis

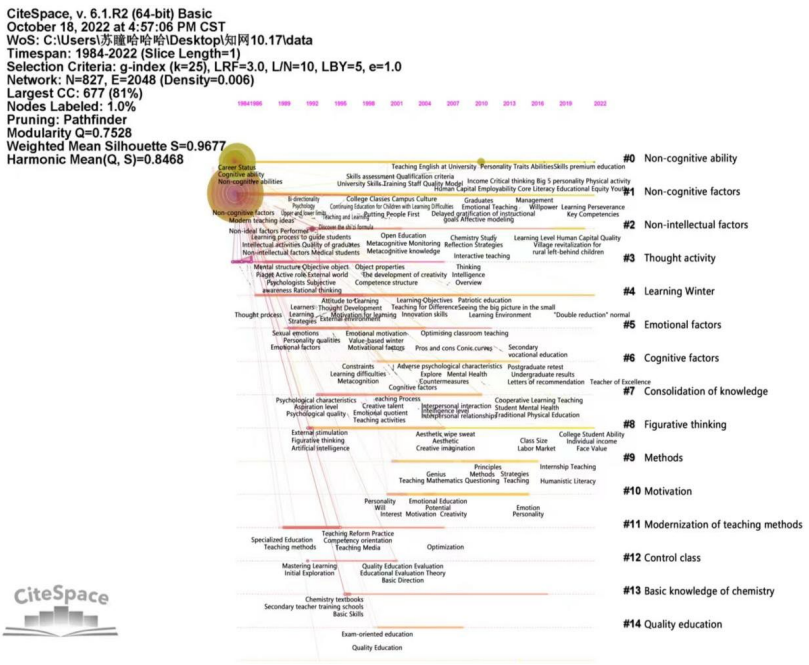

Figure 3: Timeline of domestic non-cognitive ability research

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

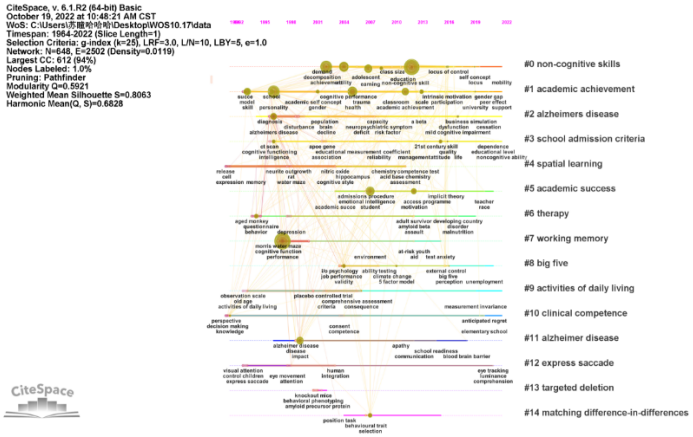

Figure 4: Timeline of foreign non-cognitive ability research

Table 2: Statistical table of keywords in non-cognitive ability research at home and abroad (top 20)

Ordinal	Frequency	Centrality	Year	Keyword	Frequency	Centrality	Year	Keyword
1	185	0.44	1984	Non-cognitive abilities	154	0.04	2011	Non-cognitive skill
2	154	1.02	1984	Non-cognitive factors	135	0.20	1997	Performance
3	84	0.20	1984	Cognitive abilities	94	0.04	2002	Achievement
4	23	0.06	2010	Human capital	86	0.04	1996	Personality
5	19	0.00	1984	Professional status	73	0.02	2011	Education
6	16	0.09	1992	Non-intellectual factors	72	0.13	2001	Ability
7	12	0.05	1993	Meta-cognitive abilities	63	0.07	2010	Outcome
8	12	0.01	2015	Non-cognitive skill	63	0.03	2005	Health
9	12	0.04	1997	Learning motivation	62	0.08	1999	Impact
10	9	0.08	2000	University student	60	0.39	1996	Alzheimer's disease
11	9	0.03	2003	Cognitive factors	55	0.06	2007	Student
12	7	0.13	1999	Academic achievement	53	0.04	1993	Skill
13	7	0.01	2018	Academic performance	53	0.06	2009	Children
14	6	0.01	2017	Family background	50	0.01	2011	Academic achievement
15	6	0.03	1984	Psychologist	47	0.02	2005	Meta-analysis
16	6	0.01	2000	Thinking skills	47	0.02	2014	Personality trait
17	5	0.02	1999	Quality education	47	0.04	1993	Model
18	5	0.02	2016	Core literacy	44	0.03	1996	Academic performance
19	5	0.02	1992	Artificial intelligence	43	0.01	2011	Technology
20	5	0.05	1993	Learning strategies	42	0.02	2012	Motivation

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

Run the CiteSpace software, select "Time line View" for node type and "Keyword" for resources, and obtain timeline maps of non-cognitive ability research at home and abroad (Figure 3 and Figure 4). Among them, the size of the node (circle) represents the frequency of occurrence of the keyword, and the top 20 high-frequency keywords at home and abroad are selected and summarized in Table 2.

Generally speaking, the keyword is a high degree of condensation of the entire article, so its frequency provides a basis for judging the research hots pots in the field to a certain extent. This paper uses the high-frequency word division formula proposed by Donohue in 1973, ie

$$T = \sqrt{\frac{(1+8I)-1}{2}} \tag{2}$$

In the formula, T is the threshold of high-frequency keywords and I is the number of keywords. After searching, the total number of domestic keywords is 827, substituted into formula (2), that is, $T = \sqrt{\frac{(1+8I)-1}{2}} \approx 40$, therefore, the 3 keywords with a frequency of 40 times or more are high-frequency keywords in this field in China, namely "non-cognitive ability", "non-cognitive factors" and "cognitive ability"; The total number of foreign keywords is 648, substituted into formula (2), that is, $T = \sqrt{\frac{(1+8I)-1}{2}} \approx 36$, and keywords with a frequency of 36 times and above are high-frequency keywords in this field abroad, including 24 high-frequency keywords such as "non-cognitive skill", "performance", "achievement", "personality", "education" and so on.

In addition, the keyword statistics table in Table 2 shows that the hot spots of non-cognitive ability research at home and abroad are both similar and heterogeneous. In terms of similarities: first, domestic and foreign studies have paid attention to the relationship between non-cognitive ability and academic achievement, and examined the influence between the two, and their common keywords include "academic achievement" and "academic performance"; Second, domestic and foreign studies believe that the important subject of non-cognitive ability is students, and its common keywords include "college students" and "students"; Third, domestic and foreign studies have regarded an individual's intrinsic motivation as a key non-cognitive ability, and its common keywords include "learning motivation" and "motivation".

Heterogeneity: from the perspective of domestic research: first, focus on the relevant concept analysis of non-cognitive ability, the keywords include "non-cognitive skills", "non-cognitive factors", "non-intellectual factors", "cognitive ability", "meta-cognitive ability" and "cognitive factors"; Second, the theory of human capital is used as the basis and quantitative standard for research in this field, which is due to the proposal of new human capital, which provides great theoretical support for relevant scholars, including "human capital", "ability", etc.; Third, it pays more attention to the study of non-cognitive ability from the perspective of "individual quality", and its keywords include "core literacy" and "quality education". From the perspective of foreign research: first, pay more attention to the intrinsic relationship between non-cognitive ability and individual characteristics, and its keywords include "Personality", "Personality trait", etc.; Second, personal performance is a hot topic in foreign research in this field, and research shows that non-cognitive ability has an important impact on individual academic achievement and career success, and its keywords include "Performance", "Achievement", "Outcome", etc.; Third, it pays more attention to the role of non-cognitive ability in the field of medicine, and explores the impact of non-cognitive factors on health, including "Health", "Alzheimer's disease" and so on.

4.2. Comparative analysis of emergent words

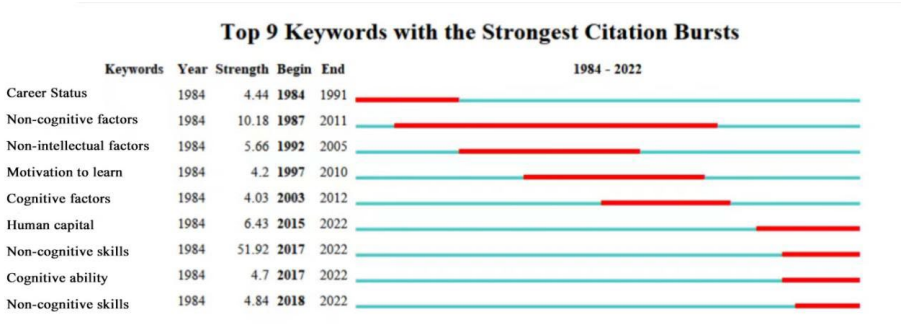

Figure 5: Foreign non-cognitive ability research keyword emergence vocabulary

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

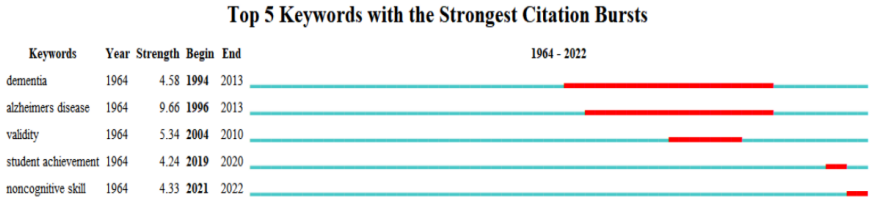

Figure 6: Foreign non-cognitive ability research keyword emergence vocabulary

Sudden words refer to high-frequency keywords that have exploded in a certain period of time, and their sudden nature can represent the academic frontier. Compared with keyword analysis, emergent word analysis can capture the inflection points and hot spots in the research field. Run the CiteSpace software, select "Burstness" as the node type, set the Minimum Duration value to 1, and obtain a list of non-cognitive ability research emergence words at home and abroad (Figure 5, Figure 6). Where Strength represents the burst intensity, Begin represents the burst start time, and End represents the burst end time.

A total of 9 emergent words appeared in the field of non-cognitive ability research in China, and the emergence period was from 1984 to 2022. Among them, keywords such as "human capital", "non-cognitive ability", "cognitive ability" and "non-cognitive skills" have continued since their emergence in 2015, and are expected to continue to attract the attention of researchers in the future and become the hot spot and frontier of research.

A total of 5 emergent words appeared in the field of foreign non-cognitive ability research, and the emergence period was from 1964 to 2022. Among them, the high-frequency keyword that has continued since its emergence in 2021 is "non-cognitive skill". The keyword "Alzheimer's disease" has a mediating centrality of 0.39 (> 0.1), indicating that this term has a significant mediating effect on knowledge networks in foreign non-cognitive ability research fields. At the same time, its sudden strength is 9.66, which is the keyword with the highest intensity of foreign sudden words, indicating that this keyword has been continuously concerned by the academic community and is a research hotspot with steady development.

5. Research conclusions and future prospects

5.1. Conclusion of the study

This paper uses Citespace software to conduct visual analysis and research on Chinese and foreign literature on non-cognitive ability at different levels, and concludes the following: First, in terms of publication trends, the trend of domestic and foreign non-cognitive ability-related research publications is basically the same, showing an upward trend, and the publication trend is roughly divided into three stages; Second, in terms of issuing institutions, the main force of non-cognitive ability research at home and abroad is still universities or colleges in various countries, which dominate the development direction of non-cognitive ability research and promote the continuous development of non-cognitive ability research; Third, in terms of authors, the concentration density of non-cognitive ability research authors at home and abroad is low, there is less academic cooperation, and a certain range of research synergy has not yet been formed, and domestic and foreign research fields are all forming a stable core author group; Fourth, domestic and foreign research hotspots are both interrelated and distinct. From the same point of view, domestic and foreign research attaches importance to the relationship between non-cognitive ability and academic achievement, and both believe that the important subject of non-cognitive ability is students, and regard personal intrinsic motivation as key non-cognitive ability. From different perspectives, domestic non-cognitive ability research focuses on the analysis from the perspectives of concept analysis, theoretical discussion and comprehensive quality of non-cognitive ability. Foreign non-cognitive ability research focuses on the analysis from the perspective of individual internal characteristics, external manifestations and disease impact.

5.2. Future Outlook

First, attach importance to international exchanges and cooperation. Based on the literature on non-cognitive ability research at home and abroad, it can be found that the research on non-cognitive ability at home and abroad has maintained a continuous hot state, which is a hot topic of academic attention.

ISSN 2616-7433 Vol. 5, Issue 6: 44-51, DOI: 10.25236/FSST.2023.050607

However, the cooperation between domestic research institutions is relatively scattered, and the research on non-cognitive ability is characterized by a single and fragmented nature, and no systematic research system has been constructed. Therefore, in the future, both academia, governments and enterprises should pay close attention to the development status and research trends of foreign countries, strengthen exchanges and cooperation between scientific research institutions, and expand cooperation with foreign institutions and authors to keep up with the frontier of research and development.

The second is to strengthen the segmentation of empirical research on non-cognitive abilities. The themes of non-cognitive empirical research at home and abroad are similar, but foreign empirical research is more segmented, the scope of research is more comprehensive, and it goes deep into the prediction, cultivation, evaluation and other levels of non-cognitive ability, forming a circular system of ability development. Domestic research mainly focuses on the economic value and influencing factors of non-cognitive ability. Therefore, in the future, we should further strengthen the exploration of non-cognitive ability prediction and evaluation, such as drawing on the assessment experience of non-cognitive skills in Canadian education jurisdictions and the prediction role of non-cognitive skills tested by Germany in the wave of SOEP, etc., based on their national conditions, through the formulation of laws and policies to build an institutional foundation, and then organize governments, enterprises, universities and other institutions as the implementation subject, and continuously improve the non-cognitive ability measurement and evaluation mechanism in the process of practice [5].

Acknowledgements

Fund: Anhui University of Finance University-level Scientific Research Project "Analysis of mismatch between supply and demand of college students' non-cognitive ability and coupling path from the perspective of employment" (ACYC2021067).

References

[1] Ye Xiaomei, Cai Juan. How much physical activity is more likely to promote non-cognitive development in adolescents? An empirical study based on China's education longitudinal survey[J]. Educational Research, 2022(09):36-42.
[2] Liberty Paul G. Jr., Pierson Jerome S., Burton Jim G. Cognitive and non-cognitive aspects of reading ability[J]. The Psychological Record, 1964, 14(3).
[3] Zhu Zhixian. A few basic questions about the study of the psychology of thinking[J]. Journal of Beijing Normal University, 1984(01):1-7.
[4] Hu Bowen. The effect of non-cognitive ability on workers' income: mechanism discussion and empirical analysis[D].Zhejiang University,2017.
[5] Ye Bei, Dong Yan. Review and enlightenment of informal learning research at home and abroad: Visual analysis based on CiteSpace[J]. Adult Education,2022,42(06):1-7.