

# 2017-2024 China Learner Portrait Research Status and Hot Spot Analysis

## -- Citespace visualization study based on CNKI

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**Abstract:** Based on the CNKI database, the article combed the research on “learner portrait” between June 2017 and June 2024, and analyzed the number of articles, the cooperation network of scholars, keywords, and other related contents to summarize the current situation and hot spots of the research on learner portrait in China. The results show that the hot topics of research mainly focus on “Student Portrait”, “Learner Portrait”, “User Portrait”, “Big Data”, “Learning Analysis” and so on, show much research innovation and integration. The related research involves a variety of fields, such as educational technology, pedagogy, computer information technology, and so on. From June 2017 to June 2024, the research hot spots gradually expanded from the application of data technology to the field of education, reflecting the trend of the integration of education and technology. The hot spots gradually shifted from applying technologies such as user portrait technology and big data to the specific application and development of the education field such as learning portrait, comprehensive quality education, smart campus, digital portrait, precise ideology, and teaching intervention. The research results provide important theoretical and practical guidance for education information technology and smart education.

**Keywords:** Learner portrait; Student portrait; Big data; Smart campus

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## Introduction

In recent years, the development of science and technology has been rapidly changing, and the achievements of science and technology have brought great changes to our life and work. With the combination of artificial intelligence technology and education, teaching methods and learning styles have also changed, becoming more dynamic and personalized. At the end of 2022, the Ministry of Education issued the education industry standard of "Digital Literacy for Teachers" to thoroughly implement the spirit of the 20th Party Congress, solidly promote the national education digitization strategy action, improve the standard system of education information, and improve the awareness, ability, and responsibility of teachers to optimize, innovate and transform education teaching activities by using digital technology. change the awareness, ability, and responsibility of educational teaching activities.2023 China has introduced policy documents such as the Education Information 2.0 Action Plan and the Guiding Opinions on Promoting the Healthy Development of Online Education, and the development of technology has given the majority of teachers more challenges and opportunities. In this environment of education digitization, drawing technology becomes more and more important. Portrait technology is a popular big data application technology that actively or passively collects various data left by users on the Internet and processes them into a series of labels, which are used to accurately portray and characterize users<sup>[1]</sup>.

Learner portrait (Learner Profile) refers to a dynamic, comprehensive and personalized description, which based on the comprehensive collection and analysis of multi-dimensional data of learners<sup>[2]</sup>. Its purpose is to gain a comprehensive understanding of learners' learning characteristics, behavioral patterns, interests, and ability levels so as to facilitate personalized teaching and precise educational support.

By searching the web of science found there are relatively few studies related to learner portrait abroad, especially about learner behavior, and learning analysis, and learning data. Aleksieva-Petrova, A et al. mentioned in the context of data merging for learning that in order to provide effective learning analysis, most systems and tools track student behavior. There is usually no interoperability between different learning systems or tools<sup>[3]</sup>. Dmello, VJ et al. analyzed the behavioral aspects of an e-learners and analyzed the important role that e-learner's behavioral intention to use plays in influencing an e-learner's engagement<sup>[4]</sup>. Because there is less data on learner portrait research abroad, the research object is set in China. The novelty of the research is that it can understand the current development level and research focus of personalized education in China by analyzing the current situation and hot spots of learner portrait research in China, and discover the deficien-

cies and gaps in it, to ensure that provide a scientific basis for the further promotion of personalized education.

## 1. Data sources and research methodology

### 1.1 Data sources

The data in this paper comes from China Knowledge Network (CNKI), and since the term "learner portrait" can be traced back to June 2017 from CNKI at the earliest, the filtering time is from June 2017 to June 2024. This paper searched through the keyword "learner portrait". Because the content is relatively new, only 356 results were retrieved. Therefore, we expanded the search scope by adding the search terms "student user portrait, student portrait" and other ranges, and retrieved more than 754 pieces of content. Removing the conference, not in line with the educational theme of the relevant content, and finally screened out 332 pieces of data as the object of visualization research.

### 1.2 Research methodology

In this study, CiteSpace (version 6.3.R2) was used as a tool for visual research analysis to quantitatively analyze 332 articles related to "learner portrait", and to form a visual map of the distribution of the number and year of publication, journal distribution, research institution distribution, and the distribution of citation frequency, and then analyze the visual map. Analyze. Combined with the literature research in related fields, the research status and hot spots of learner portrait in China are summarized.

## 2. State of the art of learner profiling research

### 2.1 The development pipeline

The term learner portrait dates from CNKI as far back as June 2017(Figure 1). The earliest article is from Shanghai Open University Polytechnic Exploration of Learner Portrait and Personalized Teaching under Open Teaching by Chen Haijian et al. The article sends personality induction and portrait in the form of labeling from the viewpoint of data mining and cognitive psychology, and discusses personalized teaching based on learner portrait. As can be seen from Figure 1, the relevant research on learner portrait initially did not attract the attention of relevant researchers. And the number of articles issued from 2017 to 2018 was very low, mainly focusing on personalized learning, based on the relevant research on learner portrait of \*\*courses, but there was a significant increase in the number of articles issued from 2019 to 2021, and a small peak was reached in 2021, with the number of articles issued reaching 62. In 2023, the number of articles peaked at 86. The research content includes the construction of learner profile model, personalized teaching, the construction of evaluation framework, accurate teaching and other aspects. The author considers that the peak of the number of articles in 2023 is related to the relevant policies issued by China, for example, in 2023, China issued the Action Plan for Education Information 2.0, the Guiding Opinions on Promoting the Healthy Development of Online Education, and other policy documents, which explicitly pointed out the need to make full use of big data, artificial intelligence and other technologies to improve the education governance capacity and the level of education services. These policies provide policy support and development direction for the application and research of learner portrait-related technologies.

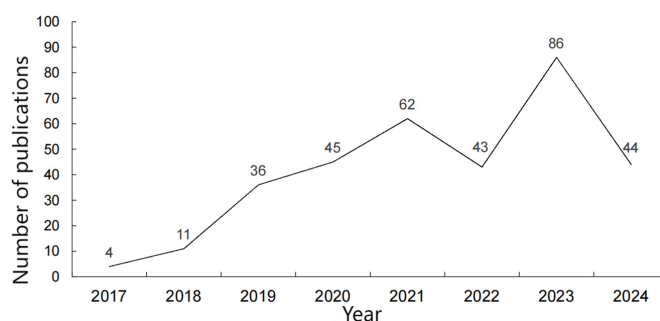


Figure 1. The distribution of the number and year of publication

### 2.2 Collaborative network of scholars who publish

The Collaboration network diagram of scholars(Figure 2) shows that Chen Haijian et al. explored the relationship between the construction of learner portraits and personalized teaching, and proposed to conduct learner portraits in the open teaching mode in four dimensions, such as basic attributes of the learner, interest in knowledge points, type of learner, and learning style preferences, and combined the static and dynamic data of the learner for data abstraction modeling<sup>[6]</sup>. Zhu Zixi et al. conducted data analysis for students' behavioral portraits to obtain students' behavioral characteristics as well as students' preliminary portraits<sup>[7]</sup>. Xu Qi et al. proposed the academic performance prediction process by using learner portraits to describe the advantages of learner characteristics<sup>[8]</sup>. All of the above scholars saw the role of learner portraits and utilized learner portrait technology as an auxiliary means of teaching to conduct relevant static and dynamic teaching research and exploration. However, from the cooperation network mapping, the cooperation between the scholars is not too close, and the scale of coopera-

tion is small [9], There will be a wider space for cooperation in the future.

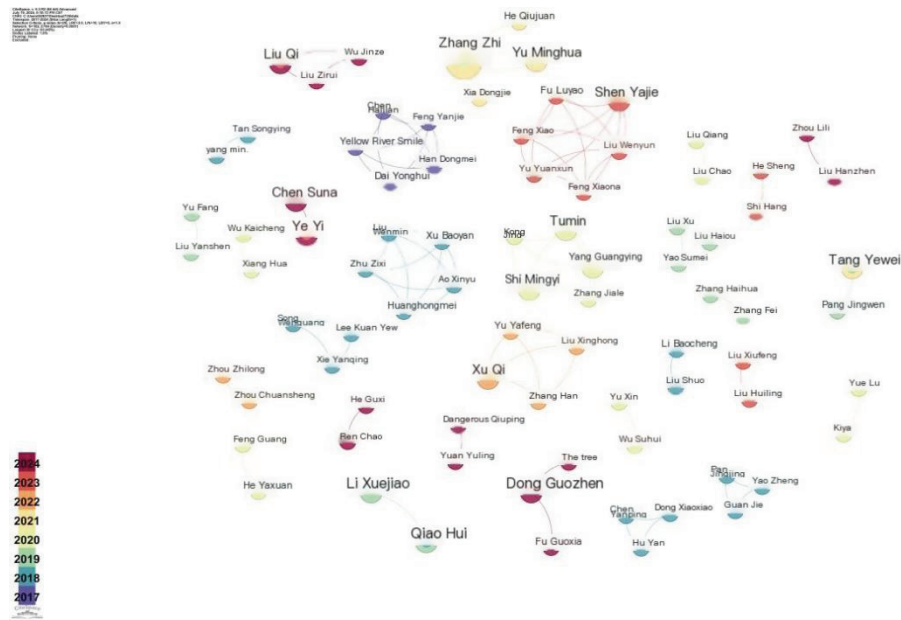


Figure 2. Collaboration network diagram of scholars

### 2.3 Collaborative network of research institutions

As can be seen from the data presented in the Research Institutions Collaboration Network Mapping (Fig. 3), the Shanghai Education Center for Electrification, East China Normal University, Central China Normal University, Inner Mongolia Normal University, and Shanghai Regional Primary and Secondary Schools are in the leading position in the field in terms of the number of publications and also show a high level in terms of the quality of the research. The main research institutions are firstly concentrated in some higher education institutions, and secondly in the field of basic education, which indicates that the research in the field related to learner portrait is still led by higher education institutions. Research cooperation presents more university-to-higher education cooperation, and cooperation between institutions is not very intensive, while there is still much room for cooperation between higher education institutions and basic education institutions. This trend is expected to advance the in-depth exploration of the field of learner portrait construction from higher education institutions to basic education institutions, and promote the development of the field toward a broader research horizon and deeper academic contributions [10].



Figure 3. Mapping of collaborative networks of research institutions

### 3. Learner portrait study's hot Spots

#### 3.1 Hot spot analysis

In the keyword co-occurrence graph (Figure 4), we can see that there are 236 nodes and 512 lines in the keyword co-occurrence network, with a network density of 0.0185. There are a few keywords with larger nodes, i.e., they show a higher frequency of occurrence, such as "student profile", "learner portrait" and "user profile". " and "user profile". Taking "student portrait" as an example, it has the highest frequency and the longest period.

By building student profiles, educators can better understand students' individual needs and learning behaviors, thus providing data support for accurate teaching and personalized learning. Secondly, "learner profiles" are similar to "student profiles", emphasizing the construction of comprehensive profiles of learners through data analysis techniques to support personalized education and teaching interventions. "User profiling is not only applied in education, but also widely used in other fields, such as library management and online learning platforms. Through user profiling technology, more accurate services and resource recommendations can be provided to enhance user experience and learning outcomes. In addition, the application of "big data" technology in education is becoming more and more widespread. Through the analysis of big data, we can gain a deeper understanding of students' learning behaviors and needs, and support educational decision-making and teaching optimization. "Learning analysis" is a method of assessing and optimizing the learning process through data analysis techniques, which has received extensive attention in educational technology research in recent years. "Data mining" techniques are used to extract valuable information and patterns from large-scale educational data to support personalized education and teaching interventions. The high frequency of these keywords: "student portrait", "learner portrait", "user profiling", "big data", "learning analysis", "data mining", "online learning", "precision teaching", "data analysis" and "smart campus", it indicates that in the current research on educational technology, researchers are generally concerned with improving the quality and effectiveness of teaching and learning through a variety of data analysis and imaging techniques, which is a hot topic in this field.

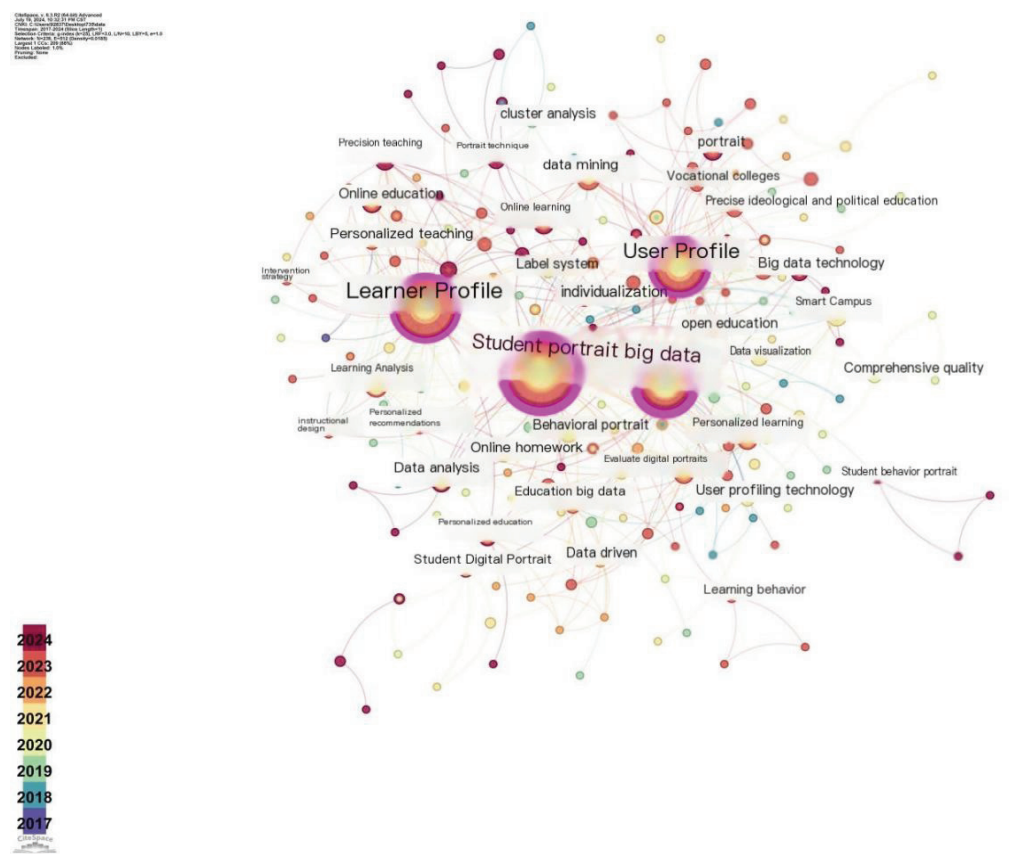


Figure 4. Keyword co-occurrence mapping

#### 3.2 Thematic distribution

The keyword clustering diagram (Figure 5) reveals the correlation between keywords and research hot spots by clustering and analyzing the keywords of a large number of literature. Based on the co-occurrence analysis, the graph gathers similar or related keywords to

gether to form multiple clusters, and each cluster represents a specific research topic or field, showing the main concerns and development trends of the field. As shown in the figure below, the clustering map of the field of "student portrait" generated by keyword clustering in the field of "student portrait" has a total of 236 network nodes, 512 lines, a network density of 0.0185, and modularity (The network density is 0.0185, the modularity Q is  $0.5556 > 0.5$ , and the mean silhouette coefficient (Mean Silhouette S) is  $0.8488 > 0.7$ , which indicates that the modular clustering is better.

Specifically, Cluster 0 focuses on the areas of personalized education and precision teaching, providing support for teaching interventions and personalized learning by constructing learner portraits, reflecting the application of educational technology in enhancing teaching effectiveness. Cluster 1 emphasizes the use of big data technology to construct student portraits and analyze students' learning behaviors to provide data support for educational decision-making, reflecting the data-driven education model. Cluster 2 focuses on the construction of user profiles in online learning environments and their application in college libraries, showing the importance of digital learning resource management. Cluster 3 focuses on learning analysis and personalized education to improve the quality and efficiency of education through data-driven and technology-enabled, reflecting the importance of educational data analysis. Cluster 4 emphasizes data analysis and personalized application in the online education environment, using big data technology to improve the quality of education, reflecting the prospects for the application of education technology in the era of big data. Cluster 5 deals with the application of user image technology in smart campus and student course selection system. Cluster 6 focuses on the application of image technology in personalized recommendation and employment guidance for college students, which improves employment services through accurate image technology, reflecting the trend of combining higher education and career development. Cluster 7 focuses on the application of data mining technology in education, demonstrating the potential of machine learning technology in education management. Cluster 8 emphasizes the role of students' digital portraits in teaching applications and comprehensive quality assessment to promote the integration of five education, reflecting the importance of digital assessment in education. Cluster 9 focuses on the application of portrait technology in the curriculum, assessing learning effects through course portraits, showing the trend of integrating educational content and technology.

By analyzing the keyword clustering mapping, we can see that the learner portrait involves a wide range of topics, covering many aspects of students, teaching, libraries, educational technology, employment, and smart education, and is mainly focused on the following three aspects:

### **3.2.1 Personalized education and precision teaching**

It can be found through the clustering mapping in Figure 5 that the main content of cluster 0, cluster 3, cluster 8 and cluster 9 focuses on personalized education and precise teaching. Detailed learner portraits are constructed by collecting and analyzing multi-dimensional data about students, such as learning behaviors, performance, habits, motivation, and technology use. Educators can use these portraits to gain insights into each student's unique needs and learning characteristics to develop personalized teaching strategies. In this process, the application of learning analysis and big data technologies is especially critical, as they make educational decisions more scientific and data-driven, realizing the optimal allocation of educational resources. Through learner portrait, personalized education can be implemented in actual teaching and learning, truly tailoring education to each student's needs and helping each student to give full play to his or her potential.

### **3.2.2 Big data technology and online education applications**

Cluster 1, cluster 4 and cluster 7 focus on the application of big data technology in education. The application of learner portrait and big data technology in education has greatly contributed to the development of personalized education. Through big data technologies, educational institutions can collect and analyze a large amount of student data, including learning behaviors, grades, interests, and online activities. Using this data, a detailed learner portrait is constructed, depicting each student's unique learning characteristics and needs. Such portraits help teachers and education administrators better understand students so that they can develop personalized teaching strategies and learning paths to enhance teaching effectiveness and learning experience. In addition, big data technology supports real-time monitoring and dynamic adjustment of teaching programs, making education more flexible and precise.

### **3.2.3 Online learning and smart campus, employment applications**

Cluster 2, cluster 5 and cluster 6 are concerned with the application of learner portrait technology in library, smart campus and student employment, using information technology to optimize the use of university library resources and the intelligence of students' course selection system, and concerned with the application of portrait technology in personalized recommendation and employment guidance for college students, to enhance the employment service and realize the precise employment of college students through accurate portrait technology.



Figure 5. Keyword clustering diagram

To sum up, the research on learner portraits focuses on three aspects: firstly, to improve the quality of education and student experience through personalized education and precise teaching as well as learning analysis; secondly, to realize the construction and personalized application of student profiles by using big data technology and data analysis of the online education environment; and finally, to focus on the specific application of user profiles in the online learning environment and the smart campus and employment, optimizing the use of university library resources and the intelligence of students' course selection system, and realizing the accurate employment of students. The research in the field of learner portrait construction is characterized by multiple levels and perspectives, involving a wide range of topics and depth. At the same time, the application of new technologies and concepts in this field also has a high degree of attention, reflecting the vitality and innovation of the field.

### 3.3 Trend analysis of hot spot changes

The keyword emergence mapping identifies keywords with a sharp increase in frequency within a certain period by analyzing the change in the frequency of keywords in the literature within a specific period. It reflects that these keywords have been highly concerned by academics in a certain time period, and are usually closely related to the research hot spots and the development trend of the discipline. The function of the keyword emergence mapping is to reveal the dynamic changes and hot spot evolution in the research field, provide researchers with references to the research frontiers and emerging trends, help them grasp the direction of the development of the discipline, and adjust the research strategy in time.

As shown in table 1, the graph reveals the evolution trend of research hot spots in the field of "student portrait". In 2017, "user portrait technology" became a hot keyword, reflecting the attention paid to the analysis and modeling technology of user behaviors and characteristics in that year, and its appearance reflects the importance of user data in the era of big data. User portrait technology is widely used in the fields of precision marketing and personalized recommendation, and its emergence reflects the importance of user data in the era of big data. In 2018, clustering analysis received widespread attention as an important method in data mining. In 2019, "big data" continues to be a high-frequency keyword. In the same year, "learning portrait" became a hot topic, indicating that the analysis and modeling of students' learning processes and characteristics in the field of education have been paid attention to. In 2020, "data analysis" became an important term in the keywords emergence chart, reflecting the importance of data-driven decision-making and data analysis technology, which is widely used in student portrait. 2021, "smart campus" emerges, indicating that education information and the construction of smart campuses have received widespread attention, and smart campuses improve education management and teaching quality through technologies such as the Internet of Things (IOT) and cloud computing. In the same year, the "digital portrait" emerges, reflecting the importance of the application of digital technology in user portrait and learning portrait. 2023, "teaching intervention" emerges, indicating that the research on the adjustment and improvement of teaching through technological means in the process of education has been emphasized. The importance of the term "pedagogical interventions" has been emphasized.

Therefore, from 2017 to 2024, the research hot spots gradually expanded from the application of data technology to the field of education, reflecting the development trend of the integration of education and technology. The research hot spots have gradually shifted from applying technologies such as user portrait technology and big data to the specific application and development of the education field, such as learner portrait, comprehensive quality education, smart campus, digital portrait, precise ideology and politics and teaching intervention.

**Table 1. Keyword emergence mapping**

Top 25 Keywords with the Strongest Citation Bursts					
Keywords	Year	Strength	Begin	End	2017 - 2024
User portrait technology	2017	1.17	2017	2018	
Cluster analysis	2018	1.56	2018	2019	
Big data	2017	1.88	2019	2019	
Learner portrait	2019	1.13	2019	2019	
Learning path	2019	1.13	2019	2019	
Micro-service	2019	1.13	2019	2019	
Data analysis	2020	1.77	2020	2021	
Comprehensive quality education	2020	1.66	2020	2020	
Behavioral portrait	2020	1.54	2020	2021	
Data visualization	2020	1.54	2020	2021	
Student digital portrait	2020	1.23	2020	2021	
Smart campus	2018	1.81	2021	2021	
Digital portrait	2021	1.5	2021	2022	
Study analysis	2018	1.14	2021	2021	
University student	2022	1.28	2022	2024	
Data-driven	2022	1.16	2022	2022	
MOOC	2022	1.16	2022	2022	
Model of instruction	2022	1.16	2022	2022	
Precise ideology and politics	2023	2.18	2023	2024	
Teaching intervention	2023	1.54	2023	2024	
Portrait technology	2023	1.54	2023	2024	
Recommended system	2023	1.3	2023	2024	
Higher vocational school	2023	1.3	2023	2024	
University library	2023	1.3	2023	2024	
Colleges and universities	2020	1.22	2023	2024	

#### 4. Conclusion

Between 2017 and 2024, research on learner portraits has experienced significant changes and developments. By visualizing and analyzing the large amount of CNKI literature, a significant increase in the number of articles published in 2023 was observed, which fully reflects the qualitative leap and enhancement of the researcher's research and output on learner portrait after the policy was introduced in 2023. Collaborating institutions are still mainly concentrated in higher education institutions, which indicates that higher education institutions are still the backbone of learner profiling-related research. This indicates that higher education institutions are still the backbone of learner profiling research, which, of course, provides more possibilities for multi-institutional cooperation and exchanges. The hot spots of research mainly focus on "student portrait", "learner portrait", "user portrait", "big data", "learning analysis", "data mining", "online learning", "Precise teaching", "data analysis" and "smart campus" and other related fields, showing a large number of research innovations and technological integration of learner profile-related content. The keyword clustering mainly focuses on the areas of personalized education and precise teaching and the use of big data technology to construct student portraits, which indicates that the construction of learner portraits provides support for teaching interventions and personalized learning, reflecting the application of educational technology in enhancing teaching effectiveness. By analyzing students' learning behaviors, it provides data support for educational decision-making, reflecting the new model of data-driven education and teaching. By analyzing the keyword emergence mapping, it is understood that from 2017 to 2024, the research hot spots gradually expanded

from the application of data technology to the field of education, reflecting the development trend of the integration of education and technology. The research hot spot gradually shifts from the application of technologies such as user profiling technology and big data to the specific application and development of the education field such as learning portrait, comprehensive quality education, smart campus, digital portrait, teaching intervention, and so on.

The research related to learner portrait involves a number of fields, such as educational technology, pedagogy, computer information technology, etc. Through the study of learner portrait, it is possible to customize the learning plan for each student and provide teaching contents and methods suitable for his/her learning styles and ability levels, to improve the learning effect and students' motivation. The learner profile also provides teachers with a comprehensive understanding of their students, identifying their strengths and areas for improvement, adjusting teaching strategies and methods, tailoring teaching to students' needs, and improving teaching effectiveness. The research on learner portraits will continue to focus on key areas such as personalized teaching, precision teaching, big data, and smart education, and these research hot spots play a crucial role in promoting education information and improving education quality<sup>[11]</sup>.

In summary, with the rapid development of big data and artificial intelligence technologies, research related to learner portrait has made some progress. Researchers continue to explore and apply new methods and technologies to better understand and support learners' learning. Different research perspectives and methods, such as personalized learning, smart education, and big data, have provided strong support for the construction of learner portraits. Meanwhile, the application of learner portraits in educational practice has become increasingly widespread, providing educators with the possibility of accurate teaching and personalized tutoring. However, despite the current research results, it still faces challenges in data privacy protection and practical application effects. In the future, how to further improve the accuracy and practicality of learner portrait under the premise of protecting learner privacy will be a direction that researchers need to work together.

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