Analysis of Data-based Learner Characteristics – Taking Fourth-grade Students in a Certain School as an Example

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Abstract: With the development of education information, a new round of scientific and technological changes and challenges have set new goals for talent cultivation and education innovation and put forward new requirements for the analysis of learners' characteristics. The use of user portrait technology in education can help teachers to keep pace with the development of learners and provides a way to promote the future development of students' learning. And data collected by electronic schoolbags in real time make data-based analysis feasible. This paper mainly uses data-based learning analysis method to analyze and mine the data of a fourth-grade elementary school. Firstly, the pre-processed data is descriptively tested to see if it conforms to the normal distribution. After that, the student's grades are standardized and clustered. Secondly, the processed data is used to map the student's comprehensive situation radar map. Based on the results of radar map and cluster analysis, targeted suggestions are put forward for learning and teaching. This study provides a reference model and a new thinking dimension for data-based learner feature analysis and the research results have theoretical value and practical significance.
Keywords: Analysis of learner characteristics; User portrait; Electronic schoolbag

1 Introduction

Since the 21st century, education information reform has been unanimously recognized in the education field. Subsequently, the "Bring Your Own Device (BYOD)" campaign, which allows every student to obtain and use a mobile device, began to be promoted (Liu Bin et al., 2016). Through these portable mobile devices, students can read various electronic textbooks and online courses and other resources needed for learning, which is conducive to the development of one-to-one digital learning. The electronic schoolbag is a new technological product born with the development of science and technology since the 21st century. E-schoolbags have been experimenting in the field of foreign education a long time ago. However, for various reasons, the development of e-schoolbags in China has not kept pace with foreign countries and started late (Tong Hui et al., 2016). It was not until 2013 that e-schoolbags finally started to be tested in China (Wang Yujie, 2018). At present, due to the characteristics of the e-schoolbag itself, its scope of application is not wide. E-bookbag trials have been conducted almost only in schools and areas with better educational resources and higher quality of teaching. The electronic schoolbag uses an electronic terminal to integrate the students' books. It can change the traditional classroom format, not only the carrier of teaching, but also the teaching model to a certain extent (Fan Minsheng et al., 2017). Electronic schoolbags are an important means of communicating traditional school education and education informatization. It creates conditions for the collection of learner data, which in turn provides strong support for the development of data-based learning analysis (Zheng Liqing, 2014).

This research is mainly devoted to the analysis of learner characteristics based on data, and at the same time, it provides a reference model and some new thinking dimensions for the analysis

of learner characteristics based on data in the background of information technology. Therefore, this research uses a series of data from e-schoolbags to analyze the characteristics of learners and make suggestions.

2 Literature Review

2.1 Learning Analysis

As an emerging field of learning analysis, its development is closely related to information technology and educational intelligence. Learning analysis uses data and models to predict the future state of learners and discover potential problems through analysis (Liu Qingtang et al., 2017). Learning analysis reports can help to better understand learners' learning styles, learning habits, and cognitive structure, and other information, so it helps teachers to prescribe the right medicine and develop personalized learning plans for students (He Kekang, 2016). In addition, through learning analysis, a comprehensive observation and recording of the entire learning process of learners can be used to grasp the learning situation of students in real time, which can help teachers make timely adjustments to their own teaching plans and teaching strategies. Nowadays, to measure, collect and analyze learners and learning environment, and get corresponding reports, and then use these reports to optimize the learning process of learners and the learning environment in which they are located. It is a technology for learning analysis. Accepted definition (Wu Yonghe et al., 2013; Siemens, 2011).

Learning analysis has attracted the attention of domestic scholars since the Horizon Report released in 2011. Gu Xiaoqing and others define learning analysis as: using different analysis methods and data models to explain the data related to learner information, and then explore the learning process and laws of learners; or interpret learners' learning performance based on data and provide them with corresponding feedback Thereby promoting more effective learning (Gu Xiaoqing et al., 2012). Learning analysis is based on the massive omni-directional data generated by students in the learning process to carry out data analysis and mining, using visual means to present the results of data analysis and mining, and then teachers and teaching administrators can carry out data analysis and mining based on the obtained predictive model The prediction of students' various learning behaviors. In this way, it is helpful to find risk learners and intervene in time. In addition, it can also push personalized learning resources and design personalized learning paths for students. Therefore, learning analysis can be regarded as achieving teaching students in accordance with their aptitude. Technical support for the purpose.

2.2 Learner Characteristics Analysis

The new round of technological changes and challenges has put forward new goals for talent training and educational innovation and has also put forward new requirements for the analysis of learner characteristics. "Taking the learner as the center" is a major purpose of the new situation classroom under the guidance of current constructivism (Yu Jiajun, 2015). Compared with the traditional classroom, the role of teacher and student are changed, so that the learner can change from a passive position to an active position and become a meaning builder. At the same time, teachers have also changed their previous roles, becoming instructors and facilitators of learning. Therefore, students are extremely important for the ability to clearly understand their own original cognitive structure and to actively construct the meaning of relevant knowledge based on their own experience. Learner analysis has become an important part of it. Based on this background, many scholars and researchers have conducted in-depth explorations on learning analysis in the new educational information environment (Xu Qi et al., 2021; Chen Changsheng et al., 2020; Sabine Seufert et al., 2019). With the development of the education field, the content

and dimensions of learning analysis are also constantly changing. On online learning platforms (such as the MOOC platform), thanks to the comprehensiveness and convenience of platform data acquisition, many meaningful research results have emerged, which has promoted the development of these platforms. However, due to the inconvenience of the acquisition and collection of offline course data, there are still problems in applying similar learning analysis techniques to traditional classrooms (Huang Qin, 2017).

Data mining on the acquired education data through learning analysis technology can provide strong support for the development of education and teaching. Learning analysis can cover the entire process from diagnostic evaluation to formative evaluation to summative evaluation, providing powerful support for schools, teachers, students, and parents to learn about teaching, learning, and results, thereby providing guidance for promoting learning and improving performance. Therefore, how to use the existing experience in traditional school education to carry out the analysis of learning that meets the new requirements of today, to promote the development of classroom education, is a problem worthy of consideration and exploration.

2.3 Learner Portrait

As far as the current situation is concerned, at the practical level of the education field, the big data user profile technology has not been tested in the true sense (Xu Yan, 2017). Learner portrait is the multi-dimensional quantification of learner's internal or external characteristics. It is an abstract student model obtained based on data analysis and mining. Learner portraits outline the image of learners through the modeling of related data, restore students' various characteristics, motivation levels and other potential attributes, and then understand learners' behavioral tendencies and needs, and derive learning laws hidden in many learners. Carrying out the analysis of learner characteristics in different dimensions for different learning scenarios can improve the design of learning platform, improve the learning recommendation system and teaching strategies (Xiao Jun et at., 2019). Most of the foreign researchers carry out research by dividing the roles of learners by certain characteristics, which include learners' learning motivation, cognitive level, and learning attitude. Scholars such as Wataru Takahashi provide corresponding services to different learners based on the motivation composition, self-efficacy cycle, and service incentive effects of different roles. Takahashi et al., 2014). Foreign scholars have also conducted in-depth research on how to build learner portraits. The goal of establishing a learner's profile is to focus on the implementation of learning needs, motivations, preferences, etc., and present the main characteristics of learners. Scholars such as Debbie Holley divide students into different risk levels, predict the learners' use of risk models, and then implement corresponding interventions. Therefore, accurately describing learning ability, providing guidance for teachers to carry out teaching, and promoting the improvement of professional skills are the important values of establishing learner profile.

With the continuous in-depth development of the concept of learner portraits, domestic scholars have gradually begun corresponding research. Through research, some scholars believe that the establishment of learner profile in a ubiquitous learning environment is an important part of the design of MOOC resources, and the evaluation of learning effects can also be achieved through learner profile (Wang Xiaofang et al., 2019). The significance of learner profile technology in personalized teaching has also been confirmed by many empirical studies conducted by domestic scholars based on experiments (Chen Haijian et al., 2017; Tang Yewei et al., 2019).

In summary, as the application of user portrait technology in education, learner portrait technology plays an important role. The learner profile technology can not only make precise positioning according to the different characteristics of learners, but also can be further used in the

optimization link of teaching design to provide targeted support for learning, to better serve personalized learning. However, at present, the research on learner profile technology still focuses on how to build models and how to apply them, and there has not been an overall description of the process of learner profile building.

3 Method

3.1 Research Path

In this research, EXCEL, RStudio, and SPSS are used to model with learner characteristics analysis method based on data. First, the obtained student performance data is standardized, and then various indicators are used for cluster analysis. Then, the standardized student performance is non-linearly transformed, and a radar chart is drawn based on the standardized student performance, and the radar chart is used to perform a single Analysis of student performance to promote the overall development of students.

3.2 Data Sources

A certain elementary school aims to promote the application of information technology in education and has carried out a long period of in-depth exploration in the use of electronic schoolbags to carry out teaching. The "electronic schoolbag" used by the fourth-grade students in this elementary school has many special functions, which can enhance classroom interaction and produce better teaching results. The emergence of electronic schoolbags has created conditions for the development of data-based learning analysis in school education, and the use of electronic schoolbags in the fourth grade of a primary school is providing a good case study for data-based learning analysis in school education. Thus, this research started. The daily teaching activities in the fourth grade of a primary school are basically carried out using electronic schoolbags. Through the electronic schoolbag, teachers use the online course platform to present teaching content, collect teaching materials, interact with students, publish assignments, and test information, and carry out evaluation activities; students use the online course platform to conduct group interactive discussions, communicate with teachers, and obtain teaching Activities such as content, completion of homework and quizzes. In this process, a large amount of student data was generated. These data include student PAD usage, classroom interaction, evaluation activities, evaluation results statistics, knowledge mastery, statistics on the number of teacher lectures, etc. Among them, some data about the evaluation activities are incompletely recorded, students' knowledge mastery in some time periods, and individual student data are missing.

The data selected in this study comes from the data in an electronic schoolbag used by 29 fourth-grade students in a primary school. The daily teaching tasks of this elementary school are basically carried out through electronic schoolbags. It can be considered that the acquired electronic schoolbag data is a good and comprehensive record of the situation of the fourth-grade students in a certain elementary school.

3.3 Data Processing

3.3.1 Standard Score

The standard score is a relative status measure, which is derived based on the original score. The standard score can represent the relative position of the original score in all the scores in which it is located. The standard score is based on the standard deviation of a group of scores, and the average of the number of components is used as a reference. It can show that the original score is several standard deviations away from the overall average in the whole, and then it reflects the

relative position of this original score in the overall data. Compared with the original score, the standard score can more intuitively reflect the meaning of the obtained data. The standard score can reflect the position of the student in the overall. As a result, the same standard score can still be regarded as equivalent even if the test is different. This also provides a method for visually comparing scores in different test contexts. From this, after converting the learner's raw scores into standard scores, it will be more comparable, especially in different times, different subjects, and different types of tests. It will be more reasonable and fairer to use standardized student scores in learner analysis.

3.3.2 Cluster Analysis

Cluster analysis is a process of classifying and combining individual abstract individuals in a whole and combining individuals with similar characteristics to form classes. Cluster analysis is an important analysis method. The clustering effect depends on two factors: the method of measuring the distance and the clustering algorithm. K-means clustering algorithm is a commonly used method of clustering analysis. Its approach can be expressed as selecting K initial centroids at the beginning. The so-called centroid is the average vector of all observations in a class. The initial centroid can be selected randomly, each centroid is a class, then each observation is assigned to the centroid closest to it, and a new class is formed with the centroid, and finally the centroid of each class is recalculated and repeated until the centroid does not occur. When changing or reaching the maximum number of iterations. This research mainly uses K-means clustering algorithm to analyze student data.

3.3.3 Non-linear transformation

The student's standard score z obtained after conversion is a standard normal distribution N(1, 0). In order to facilitate the use of the obtained standard scores in subsequent analysis, non-linear conversion processing is performed on them.

The nonlinear conversion formula used is $z' = \frac{1}{\pi}\tan^{-1} z + 0.5$.

The transformation has the following characteristics:

(1) Convert the infinite interval from negative infinity to positive infinity into a finite interval from 0 to 1;

(2) Convert the original average value of the standard score (z) from 0 to an average value of 0.5;

(3) The function obtained after transformation has good linearity near the average value, and the more it deviates from the average value, the stronger its compressibility.

3.3.4 Radar chart

The radar chart is a graphical method of displaying multivariate data in the form of a two-dimensional chart of three or more variables on an axis starting from the same point. The radar chart is composed of a series of equidistant concentric circles. Each of the concentric circles corresponds to a different value, the closer to the center of the circle, the smaller the value, and the greater the deviation from the center of the circle, the larger the value. The evaluation index of the radar chart is represented by multiple axes drawn from the center of the circle. The value corresponding to each index obtained is processed and marked on the index axis according to a certain ratio, and then the marked points obtained by these marks are aligned. If you are connected to each other, you can get a radar chart that reflects each evaluation index of the sampled book.Radar chart plays a very good role in both qualitative analysis and quantitative analysis.

4 Results

4.1 Overall Characteristic of Learners

Use SPSS to explore the PAD use time and reading time in the obtained student data, and judge whether it obeys the normal distribution. The results are shown in Table 1. The absolute values of the skewness coefficient and kurtosis coefficient of the two indicators are both less than 1, which can be regarded as approximately obeying a normal distribution.

Table 1. Statistical results of PAD use time and Reading time

		Statistics		Standard Error	
		PAD use time	Reading time	PAD use time	Reading time
Mean		1157.497	39.735	131.4139	6.2917
95% confidence interval of the mean	Lower limit	889.114	26.886		
	Upper limit	1425.880	52.585		
5% trimmed mean		1109.367	37.654		
Median		827.000	28.000		
Variance		535358.163	1227.140		
Standard deviation		731.6817	35.0306		
Minimum		340.0	2.4		
Maximum		2889.7	115.6		
Scope		2549.7	113.2		
Interquartile range		1061.0	59.5		
Skewness		.894	.904	.421	.421
Kurtosis		-.156	-.478	.821	.821

After sorting out the obtained student's original scores, select the entire class of students in a certain test, and standardize the student scores in the following way.

(1) Obtain the scores of n students in the test in order of x_1, x_2...x_n, calculate the average score of the whole class of students who participated in the test μ: $\mu = \frac{\sum_{i=0}^{n} x_i}{n}$;

(2) Calculate the standard deviation σ of the obtained scores of n students in the test: $\sigma = \sqrt{\frac{\sum_{1}^{n}(x_i-\mu)^2}{n}}$;

(3) According to the standard score conversion formula, the original scores obtained by each student in the test are converted into standard scores for easy comparison by calculation. The formula is $z = \frac{x-\mu}{\sigma}$.

Some of the final processing results are shown in Table 2.

Table 2. Standardization

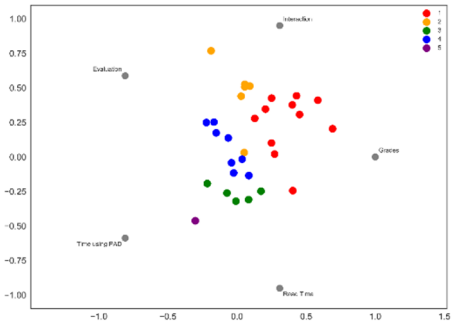
Student	Chinese	Math	English
Chen	0.104	0.482	-0.009
Dai	0.297	-0.184	-0.460
Du	0.406	0.251	0.298
Feng1	-0.445	0.372	0.138
Zhang3	0.288	0.149	0.298

Standardize students' classroom performance, teacher evaluation, pad use time, and reading time data. Select five indicators: performance indicators, evaluation indicators, interaction indicators, PAD use time, and reading time, and use SPSS to perform cluster analysis. It is divided into 5 categories, Table 3 shows the cluster analysis results.

Table 3. Cluster center

	Cluster				
	1	**2**	**3**	**4**	**5**
performance	.1212	-.1421	-.0464	.1117	-.2021
interaction	-.0923	.0337	-.1015	.1630	-.4146
evaluation	-.1005	.1645	-.1369	.1143	-.4125
PAD use time	-.2390	-.2416	.1967	.2334	.2457
reading time	-.1174	-.1465	.2163	-.0561	-.1798

RadViz radar chart can complete multi-dimensional data visualization tasks and is suitable for visualization of cluster analysis results. It is based on the basic spring pressure minimization algorithm often used in complex network analysis. The spring algorithm puts a series of nodes in the same plane, and then assumes that each data set uses a spring to connect to each node. Therefore, these nodes will move due to the existence of springs and stop when all the elastic potential energy of the entire system reaches a minimum. In the RadViz radar chart, different



colors are used to identify different classes. Figure 1 shows the drawing result.

Figure1. RadViz radar chart

The first category of cluster analysis results contains 11 students. These 11 students have good performance in performance indicators, but most of them do not perform well in classroom interaction, teacher evaluation, PAD use time and reading time indicators. Through analysis, we can clearly know that they are all able to achieve good results, but they do not tend to use PAD as a learning tool and prefer traditional book learning, nor do they like to interact with teachers in the classroom. From a long-term perspective, although such students can better complete their academic tasks through independent learning, they should still interact and communicate more with teachers, to help them discover new problems in their communication with teachers. At the same time, even if such students use less e-bookbags, they can still achieve better results. Teachers can still guide these students to use modern tools to help them learn, so that students can realize the power of the new learning tool of e-bookbags. The convenience provided for their study.

The second category of cluster analysis results includes 6 students. These 6 students have good performance in classroom interaction and teacher evaluation indicators, but most of them do not perform well in performance indicators, PAD use time and reading time indicators. This shows that although they actively participate in the interaction in the classroom, they can also get good evaluations from the teachers in the classroom, but they still cannot achieve satisfactory results. This kind of students are also more common in the classroom. Although they are active in the classroom, they may not get a good grade due to inappropriate learning methods and methods. Therefore, helping such students find a learning method that suits them is one of the key points to improve their academic performance. In addition, teachers can also consider starting from the use of PAD and consider whether these students are unable to achieve the expected results compared with other students, whether it is because they did not maximize the help effect of e-schoolbags on learning. Correct guidance to improve student performance.

The third category of cluster analysis results includes 5 students. These 5 students have outstanding performance in PAD use time and reading time indicators, but most of their performance indicators, classroom interaction indicators and teacher evaluation indicators are not optimistic. For such students, it should be considered whether they have not properly played the role of PAD, an e-schoolbag. When these students use e-schoolbags, they are likely to use it as an entertainment tool and fail to achieve the purpose of e-schoolbags to help and promote learning. These students should be guided in a timely manner, and they should be guided to use e-schoolbags to help their learning, instead of using them as a novel pastime and play tool. The real significance of introducing e-schoolbags is to use the value of e-schoolbags.

The fourth category of cluster analysis results contains 8 students, these 8 students have a good performance in other aspects except for the lower PAD reading time indicator. This shows that these 8 students can better promote their own learning through the interaction with the teacher in the classroom, can also get a better evaluation from the teacher, and can also use the electronic schoolbag to complete the learning task better. In addition, these 8 students can consider using e-bookbags to read more, study textbooks, content outside the classroom, enrich their knowledge content, and achieve better performance.

The fifth category of cluster analysis results includes 1 student. This student has outstanding performance on the PAD usage time indicator, but the performance on other indicators is not optimistic. This student is like the 5 students in the third category, and it should be determined in a timely manner whether he has correctly played the role of the e-schoolbag and actively guided.

From the above analysis, different students have different attitudes and situations towards learning with electronic schoolbags. However, it is not difficult to find from the results that the current students' acceptance and use of e-schoolbags need to be improved, and e-schoolbags still do not fully exert their value in helping to learn to a certain extent.

Through cluster analysis, 31 students are divided into 5 categories according to the five dimensions of performance indicators, evaluation indicators, interaction indicators, PAD usage indicators, and PAD reading time indicators, which helps to intuitively and clearly grasp the various Dimensional performance, and promptly discover possible problems in the learning process of students, so as to help teachers to carry out personalized teaching and prescribe the right medicine, so as to guide students to better aspects and promote the overall development of students. In addition, clustering analysis based on data can not only improve the efficiency of teachers in understanding the situation of students, but also more scientifically obtain the situation of students from the observation and feeling of teachers in traditional classroom teaching and has a good guidance for the development of teaching. significance.

4.2 Individual Characteristic of Learners

Table 4 shows some of the processing result after non-linear transformation.

Table 4. Processing result after non-linear transformation

Student	Chinese	Math	English
Chen	0.533	0.643	0.497
Dai	0.592	0.442	0.363
Du	0.623	0.578	0.592
Feng1	0.367	0.613	0.544
Dai	0.589	0.547	0.592

Do the same processing with the obtained data of student classroom performance, teacher evaluation, pad use time, and reading time, and select indicators Chinese score, Chinese evaluation, Chinese interaction, math score, math evaluation, math interaction, English score, English evaluation, English interaction, PAD use time, reading time 11 indicators, use RStudio to draw a radar chart.

When drawing, convert the 11 selected indicators into 11 corresponding dimensions in the radar chart. According to the results of data processing, the more the indicator point deviates from the central origin, the better the student's performance on the indicator. From the perspective of the area of the closed figure enclosed by each indicator point of the radar chart, if the area of the closed figure is larger, the overall situation of the students is better.

4.2.1 Case Study 1

Figure 2 is a radar chart of Zhang's comprehensive situation. From the figure, we can see that Zhang's mathematics performance indicators, mathematics evaluation indicators, English performance indicators, English interaction indicators, and PAD use time indicators are all close to the maximum value of the class. Reading time indicators, language interaction indicators, and English evaluation indicators It is higher than the average of the whole class, the Chinese performance index and the Chinese evaluation index are close to the average of the whole class, and the mathematics interaction index is lower than the average of the whole class.

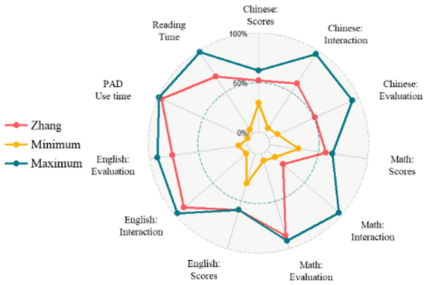


Figure2. RadViz radar chart of Zhang's comprehensive situation

(1) Teaching interaction. By observing the three interactive indicators of Zhang's Chinese, Mathematics, and English, we can find that Zhang can interact well with teachers in Chinese and English classes, but he did not interact with teachers to a similar degree in math class. This shows that in terms of teaching interaction, Zhang's situation is better, but he still needs to pay attention to his interaction in the mathematics class and find the reasons for his low mathematics interaction indicators, such as the tendency to teaching methods.

(2) Technical application. From the two technical application indicators of Zhang (PAD use time and reading situation), we can find that Zhang's PAD use time indicator is close to the highest value of the class, and his reading time indicator is also higher than the average of the class. This shows that Student Zhang can use the electronic schoolbag to study well and complete the tasks assigned by the teacher.

(3) Subject analysis. From the radar chart of Zhang's comprehensive situation, we can find that Zhang's English scores and math scores are close to the highest value in the class, indicating that Zhang has a good performance in these two subjects. In contrast, Zhang's Chinese performance is a bit weak, and his Chinese performance indicators are only close to the average Chinese performance of the whole class. As a Chinese teacher, he should pay more attention to its internal reasons, such as whether the learning method is inappropriate, the learner Zhang himself can also improve his language performance through self-reflection.

(4) Teacher evaluation. Among the three teacher evaluation indicators of Zhang, the mathematics evaluation index tends to be the highest in the class, and the English evaluation index is also higher than the average of the class, indicating that Zhang can be highly recognized by the teachers in these two subjects. However, Zhang's language evaluation index is only near the average of the class. Based on the analysis of Zhang's language performance indicators and language interaction indicators above, there is still a lot of room for improvement in Zhang's performance in language subjects.

4.2.2 Case Study 2

Figure 3 is a radar chart of Teng's comprehensive situation. From the radar chart, we can understand that Teng's PAD usage time and English performance indicators tend to be the highest in the class. In addition, Teng's Chinese performance indicators, language interaction indicators, language evaluation indicators, and mathematics scores the indicators, mathematical interaction indicators, mathematics evaluation indicators, English interaction indicators, English evaluation indicators and PAD reading time indicators all reach the average of the class or even tend to the lowest value of the class.

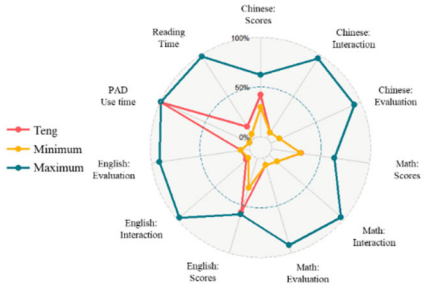


Figure3. RadViz radar chart of Teng's comprehensive situation

(1) Teaching interaction. Observing and analyzing the interactive indicators of Teng's three subjects, it can be found that these three interactive indicators of Teng are close to the lowest value of the whole class. From this we can infer that student Teng does not like to participate in learning by interacting with teachers in class. In this regard, teachers may consider guiding Teng. When considering Teng, it is for reasons of character to guide him to participate more actively in the classroom.

(2) Technical application. From the use of Teng's PAD and reading time indicators, we can find that Teng's PAD is used more frequently, and it is understood that most of Teng's other indicators are basically the lowest in the class, indicating that Teng Although students often use the electronic schoolbag as a tool, they may not give full play to the value and function of the electronic schoolbag. Based on this problem, the teacher should provide timely guidance to achieve the purpose of the electronic schoolbag to promote learning.

(3) Subject analysis. Observing Teng's Chinese, math, and English performance indicators, we can find that, except for the English performance indicators tending to the highest value of the class, the other two indicators are close to the lowest value of the class. This shows that Teng can achieve good results in English subjects, but his performance in Chinese and mathematics subjects is not good. This may be due to Teng's preference for English subjects. In this regard, teachers should start from the perspective of the content of each subject to help Teng understand the meaning of each subject to himself, to stimulate Teng's inner motivation for learning other subjects and promote the overall development of his various subjects.

(4) Teacher evaluation. Analyzing the teacher evaluation indicators of Teng in the three subjects of Chinese, mathematics, and English, we can find that Teng has not been able to get a good evaluation of the teachers in these subjects. Comparing and analyzing Teng's teaching interaction indicators and subject performance indicators, we found that they are almost corresponding. Therefore, teachers need to consider whether this is caused by Teng's learning interest or lack of learning motivation. After investigating and clarifying the reasons, they will prescribe the right medicine to help Teng become a better learner.

4.2.3 Comparative Analysis of Two Cases

By observing the radar chart of the two students, we can also observe the overall situation of the students through the area of the closed figure, that is, the larger the area of the closed figure, the better the overall situation of the students. Comparing the radar charts of the two students, we can easily find that the two students performed similarly on the English performance indicators and the PAD usage time indicator.

Judging from the three performance indicators alone, Zhang's performance in each subject has achieved a more balanced development, while Teng's performance in Chinese and mathematics is still very lacking in addition to English. This is easily reminiscent of the law of short boards. The amount of water that a wooden barrel can hold depends on the shortest wooden board of the wooden barrel, not the longest wooden board of the wooden barrel. Each of us is like a wooden barrel, with its own length and shortness. The longer plank can naturally help us to have some outstanding performance, but in the end our development will be largely determined by the shortest plank, so We should work hard to make up for the shortcomings. As a student, you should also achieve a balanced development of all subjects to promote your own outstanding development. Through the radar chart, students can clearly and intuitively find their shortcomings and try to make up for them.

5 Discussion

By drawing and analyzing the radar chart of the overall situation of students, it is helpful for teachers to grasp the situation of all students from the overall situation and formulate teaching strategies in the general direction. Analyzing the radar chart of a single student will help teachers better carry out personalized teaching, understand the strengths and weaknesses of students, and prescribe the right medicine to promote the all-round development of students. By observing their own data analysis radar chart, students can intuitively understand their own development in various aspects, more immediately understand their own strengths and deficiencies, guide students to learn to check for missing vacancies, and promote students to form a self-reflection, self-promotion, and self-improvement Virtuous circle.

Using the large amount of student data generated in real time during the use of the electronic schoolbag to perform corresponding learning analysis and generate student characteristic analysis is of broad significance for the development of further teaching and the progress of student learning. From a practical point of view, the analysis of learner characteristics based on data has the following significance. First, for students, obtaining learner characteristics analysis based on data analysis will help students to understand their real-time strengths and weaknesses more intuitively in time, forming a virtuous circle of self-reflection and self-promotion. Second, as far as teachers are concerned, obtaining real-time characteristics analysis results of students can help teachers better meet the needs of providing personalized teaching, grasp the strengths and weaknesses of students, and then set personalized development goals to guide students toward complete and comprehensive development. Third, for parents, compared to

simply knowing the learning results of students through test scores, feature analysis based on student learning data can provide parents with a measure of measurement. From a theoretical point of view, this research can provide a reference model for data-based learner characteristics analysis under the background of information technology. This research involves the use of a series of data including statistics on students' classroom performance, statistics on the mastery of students' knowledge points, statistics on the use of students' electronic schoolbags, statistics on student performance trends, completion time and completion statistics of student homework and tests, etc., to analyze and generate a series of data. Series learner characteristics. This data-based learner characteristic analysis mode can provide a reference for the development of learning analysis, and it also provides some new thinking dimensions about learner characteristic analysis.

There are still shortcomings in this research. Due to the large and complex data obtained, there is not much data left after actual screening, especially the data of some individual students have serious lacks, and some subjects and knowledge points cannot be determined, so students cannot be determined. The individual performance in each period is compared longitudinally. In addition, the originally obtained student performance data is not only Chinese, mathematics, and English, but also student science and other subjects. However, due to the small number of these subjects and the large time interval, they are not suitable for analysis. Therefore, this study only analyzed the three subjects of Chinese, Mathematics, and English.

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