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The Dynamic of Learning Innovation of College Students Based on Big Data Analysis

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Abstract: *In the management of modern higher education, the level of information is improving year by year. Over the years, with the wide use of school network system and the accumulation of data in the main business system, the big data environment has gradually formed within the school. This paper will mainly explore the motivation of innovative learning for college students based on this big data environment. This paper mainly analyzes and studies the students' learning behavior data stored in the relevant business systems of colleges and universities, discusses the correlation between students' learning, life and psychology, excavates abnormal data, and makes full use of these analysis results. The purpose of this paper is to use big data related technology to analyze and study students' learning and innovative behavior data in order to make full use of students' behavior data and provide the basis of data analysis for the overall development of students' moral and intellectual ability. This paper analyses the practical ability of college students' innovation from the perspective of colleges and universities in this province, in order to explore the reference significance for the cultivation of college students' innovative practical ability in China. The experimental research shows that 32.3% of the junior students hope to improve their practical ability during college.26.3% hope to master solid professional knowledge. The school should cooperate actively to create an environment for students to improve their learning innovation ability.*

Keywords: *Big Data Analysis, College Students, Learning Motivation, Innovation Motivation*

1. Introduction

With the continuous construction of university digitization and the continuous increase of campus management application system and campus card service platform, the data accumulated in campus information environment is gradually expanding. And the traditional data analysis technology of college students has been far from meeting the increasing data processing requirements of college students [1-2]. How to effectively manage and share a large number of educational resources on campus and make rational use of these large amounts of data to assist classroom teaching has become an important problem in the present era [3-4]. Through advanced big data analysis technology, studying and standardizing students' independent learning and innovation behavior is helpful to cultivate and improve the level of students' management in colleges and universities in China, and to make decisions on students' work effectively by using data, to study the law of college students' growth and development [5-6]. Big data can record a student's growth experience and analyze it scientifically, so that a student can know more about himself [7-8].

Many scholars have discussed its application in learning innovation power in the face of massive data generated on campus, such as: Martin Lamb has studied the lack of motivation of language education, that is, learners. It emphasizes the complexity of the relationship between teaching and learning motivation, and points out the most promising way [9] future research. Wang Wei and Xu Huiying et al found that enhancing students' learning motivation can reduce their perceived stress and establish more positive emotions. Positive emotions in the learning process play an important role in helping students improve their skills and professional ability [10].

Based on the large amount of data accumulated by middle school students in the campus information environment, this paper constructs the student's behavior characteristic database, and analyzes the students' demand for behavior subdivision. From its living habits and learning efforts and other aspects to analyze the construction of a student behavior descriptive indicators. Based on the established learning behavior index, this paper designs the behavior subdivision model of ordinary

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college students based on cluster analysis, and widely applies the k -means clustering algorithm to the learning behavior clustering of ordinary college students, analyze the behavior of common college students. From the practical point of view of colleges and universities in this province, this paper discusses the countermeasures and suggestions to cultivate the innovative practical ability of college students in China.

2. Research on the Dynamic of College Students' Learning Innovation Based on Big Data Analysis

2.1 Definition of Relevant Concepts

(1) Innovative talents

Along with the development of the times, innovative talents have a deeper and more extensive explanation, and also make innovative talents have different characteristics of the times and behavior performance [11]. Nowadays, the so-called innovative talents are those with innovative spirit, innovative consciousness, innovative thinking and innovative ability. They usually show flexible, open and curious personality, with the characteristics of energetic, persistent, focused, imaginative and adventurous.

(2) Innovative practical capacity

Innovation practice ability is put forward on the basis of the concepts of innovation spirit, innovation ability and practice ability. According to the author of this paper, college students' innovative practical ability refers to the ability to use existing professional knowledge to solve practical problems creatively, to transform creative thinking into concrete actions, and to unify ideas and actions, and the ability to produce innovative results [12]. Based on the angle of college students, it is necessary to have innovative thinking and high level of innovation motivation to have good innovative practical ability, and then to have a solid foundation of professional knowledge and learning ability.

2.2 Cluster Analysis Methods

Cluster analysis is a common method in data mining and an unsupervised learning mining method. Clustering is the process of grouping physical objects or abstract object sets into multiple clusters composed of similar objects. The principle of classification is to ensure similarity and difference between classes. Finally, the clustering results are studied and analyzed to determine the meaning of each cluster.

By measuring the similarity of intra-class and inter-class objects, the clustering effect can be judged. The higher the intra-class similarity, the lower the inter-class similarity, the better the clustering effect. Generally speaking, for a set of classes, the similarity between classes is defined as:$C = \{c_1, c_2, \cdots, c_k\}$

$$S_{sim} = \frac{\sum_{i=1}^{k}\sum_{j=i+1}^{k} s(c_i,c_j)}{0.5 \cdot k \cdot (k-1)} \tag{1}$$

$s(c_i, c_j)$For the C of two classesiand CjThe similarity between them is measured by the similarity of clustering centers. For a class, its intra-class similarity is defined as:

$$S_{sim-in}(c_i) = \frac{\sum_{i=1}^{n}\sum_{j=i+1}^{n} s(x_i,x_j)}{0.5 \cdot n \cdot (n-1)} \tag{2}$$

Similarly, when distance is used to measure the relationship between data objects, the smaller the corresponding intra-class distance and the larger the inter-class distance, the better the clustering effect is.

Clustering analysis is usually divided into different clustering methods based on stratification, division, density and model.

2.3 K-Means Algorithm

K-means clustering algorithm, also known as k- average or k- mean clustering, is a very widely used clustering algorithm. K-means clustering algorithm is a very classical unsupervised learning clustering algorithm based on partition. It depends on a basic assumption: for each data class cluster, a cluster center point is selected. The distance from all points in this cluster to the center point is less than that to the center of other clusters. The core idea of the K-means algorithm is to randomly select k data

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sample points from the data set S to be classified as the center of the initial clustering, and calculate the similarity between the data sample points through the Euclidean distance. The samples in the s are divided into the nearest clusters.

$S = \{x_1, x_2, \cdots, x_n | x_i \in R^t\}$There are n data samples to be clustered, in which the xi is a t dimension feature vector. The goal of K-means clustering is to find the set of points and the objective function$C = \{c_1, c_2, \cdots, c_k\}$

$$f(X, C) = \sum_{i=1}^{k} \sum_{x_j \in S_i} d(x_j, c_i) \tag{3}$$

$S_i c_i d(x_j, c_i) x_j$The sample set of the i category, the class center point of the i category, and the distance between the sample point and the class center point are defined as shown in formula (4).

$$d(x_j, c_i) = \|x_j - c_i\| = \left(\sum_{m=1}^{t} |x_{jm} - x_{im}|^2\right)^{\frac{1}{2}} \tag{4}$$

Of which

$$c_i = \frac{1}{n_i} \sum_{x_j \in c_i} x_j \tag{5}$$

n_iRepresents the number of sample points in the i category and the sample points belonging to the i category.x_j

2.4 Analysis of Students' Learning Behavior Based on K-Means Algorithm

(1) Student Behavior Subdivision Needs

It is one of the goals of big data analysis to subdivide and reasonably classify students' learning behavior, to provide individualized management and service to different kinds of students, and to improve the accuracy of student management and service. It is also one of the methods to analyze students' learning motivation. Subdivide students according to their learning characteristics is helpful to analyze the power source of students' learning, is the basis of individualized management for different students by school managers, and is helpful to improve the teaching effect of schools. At present, the traditional classification of students in the school after the division of the unified management model, can not accurately and comprehensively find out the characteristics of student categories, can not directly show the learning characteristics of all kinds of students. According to the data in the campus system, this paper constructs the relevant indexes which can reflect the value of students' learning behavior, then sets the weight according to the selected index data, and then uses the clustering algorithm in data mining to subdivide students. Finally, the characteristics of learning behavior are determined by clustering results.

(2)Student behavior indicators

In the design of the index system of students' learning behavior description, this paper describes the students' campus behavior from many aspects, such as living habits and learning efforts, according to the existing achievements, educational attendance, access control, books, network logs and other data in a university digital campus sharing data platform. The index of students' learning effort is mainly divided into classroom attendance rate, book reading quantity, library entry and exit times, study time, weighted average score, course pass rate and so on.

(3) Results of effort clustering

After clustering the degree of effort of students' learning, nine types are obtained. The first type of students, not enough effort, more lazy. The second type of students, usually study very hard and diligent high achiever students. The third type of students, very smart, but not enough energy in learning, not enough attention to learning. The fourth type of students, often do not attend classes, the course almost all red light type of learning slag. The fifth type of students, in peacetime learning more lazy, do not like to learn, but more attention to the curriculum. The sixth type of student makes special efforts in learning, but learning methods are not important or limited in understanding knowledge. The seventh type of students, the degree of effort compared with other students are moderate. The eighth type of students, there is a certain volatility. The ninth type of students, many indicators are relatively low, in peacetime learning efforts are not enough, although more diligent than the fifth class of students.

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3. Research on Dynamic of College Students' Learning Innovation Based on Big Data Analysis

3.1 Cluster Analysis Data

(1) Source of data

The experimental data source of this paper is the historical record data accumulated by the management system of the campus departments made by the data in the digital campus sharing database of a certain university. The original data include the library book borrowing record data from September 2018 to September 2020, a total of 2485314 items, a total of 9546568 records, library access record data, a total of 2846325 items, as well as the student achievement data, physical exercise record data, and the campus wireless network access record data.

(2) Data processing

This paper uses Sqoop tools to transform the integrated data and import it into the distributed cluster HDFS. After data cleaning and preprocessing based on Spark, the student learning feature library is established by statistical analysis, experiment based on student learning index. According to the student behavior description index, the K-means clustering algorithm is used to analyze the student segmentation.

3.2 Investigation on Cultivation of College Students' Learning Innovation Ability

(1) Survey subjects

This paper takes the cultivation of innovative practical ability of local college students as an example.

(2) Methods of investigation

Use the method of questionnaire survey. The questionnaire design adopts anonymous survey method, which mainly focuses on the influencing factors of students' innovative practical ability and the way of school training, and tries to provide real and effective data for this survey. The questionnaire was distributed through the school management system, a total of 671 questionnaires, 657, of which 654 valid questionnaires.

(3) Statistics

By SPSS, EXCEL software, this paper makes statistical analysis of the questionnaire results.

4. Analysis of Dynamic Experiment of College Students' Learning Innovation Based on Big Data Analysis

4.1 Cluster Results of Efforts

After using the K-means algorithm to cluster and subdivide the degree of students' learning effort, the students are divided into 9 categories in terms of the degree of learning effort, and the proportion of students in each cluster is calculated. The average pass rate and length of study are shown in Table 1:

Table 1: Results of Effort Clustering

	0	1	2	3	4	5	6	7	8
Percentage of students (%)	6.35	16.94	12.96	3.94	4.36	21.46	11.74	10.39	11.86
Attendance indicators	0.60	0.95	0.71	0.37	0.45	0.87	0.77	0.59	0.65
Course Pass	0.65	0.98	0.91	0.50	0.60	0.95	0.84	0.78	0.64
Length of study (day)	85	214	181	97	107	221	159	190	143

As shown in Figure 1, of the nine categories, the fifth category has the largest number of people, the longest learning time and the highest attendance rate. However, some students have insufficient motivation and low desire. Schools should guide them to enhance students' interest in learning.

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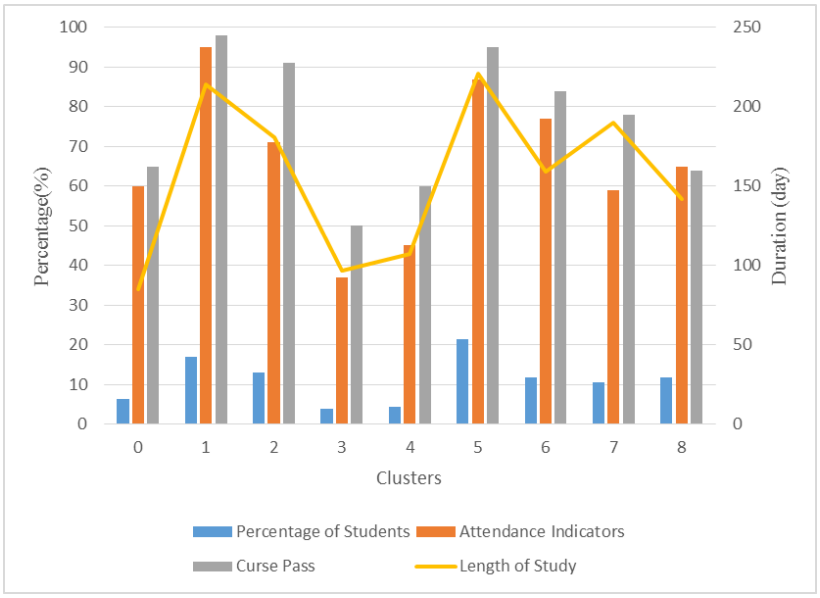

Figure 1: Results of Effort Clustering

4.2 Investigation on the Cultivation of College Students' Learning Innovation Ability

College students' learning innovation ability is closely related to students' vital interests. Students' own evaluation and judgment have great reference value for understanding the current innovation power of college students. Find out the current situation of college students' learning innovation ability training investigation. Table 2 Questionnaire on the areas where students most wanted to develop during university:

Table 2: What are the most desirable aspects of university development

	Practical Capacity	Professional Knowledge	Future Employment	Interpersonal Relationships	Adaptation Capacity	Other
Freshman	16.70%	31.90%	5.10%	15.90%	26.70%	3.70%
Sophomore	20.40%	33.90%	7.20%	10.60%	5.50%	22.40%
Junior	32.30%	26.30%	19.70%	15.50%	4.60%	1.60%

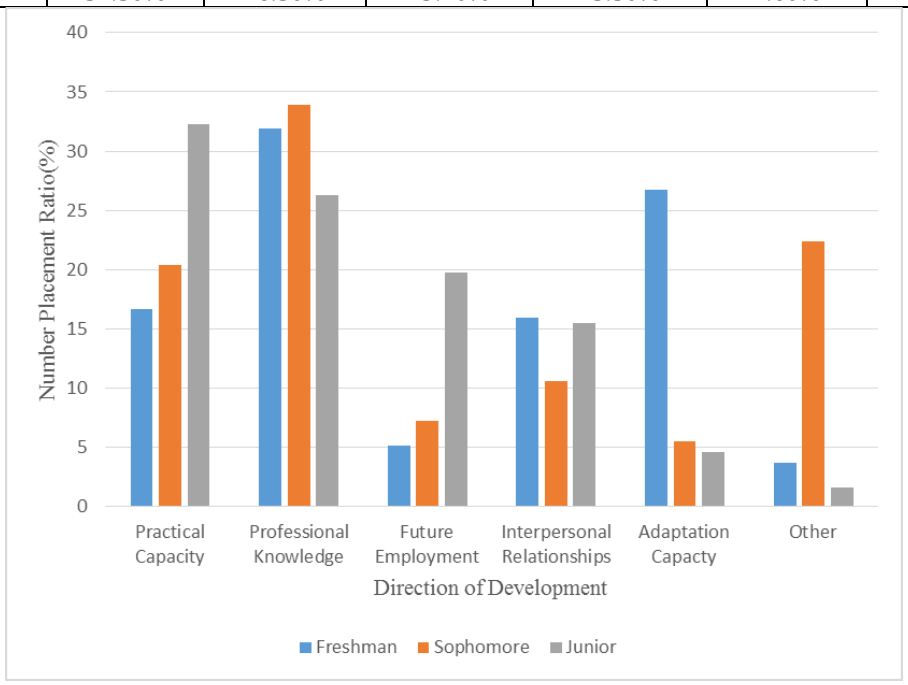

Figure 2: What are the most desirable aspects of university development

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As can be seen from Figure 2, 32.3% of junior students want to improve their practical ability during college, 26.3 per cent of students want solid expertise. In different grades, they want to achieve different goals, but most of them want to improve their learning and innovation ability. This shows that contemporary college students have the idea of improving their own learning innovation ability, and schools should actively cooperate to create an environment for students to improve their learning innovation ability.

5. Conclusions

Cultivating innovative talents is the fundamental task of colleges and universities. It is an important measure to carry out innovative practical education and improve college students' innovative practical ability. With the rapid development of economy and society, higher education has put forward new requirements for the cultivation of innovative talents. In order to cultivate applied talents with innovative spirit and practical ability, it is necessary to understand students' demand for learning and innovation ability, attach importance to innovative practical education, increase financial support, concentrate superior resources to strengthen the construction of teachers, and focus on the improvement of students' innovative practical ability. This subject revolves around the students' learning behavior data in school. Through the big data analysis and mining of the students' behavior data accumulated in various business systems for many years, the urgent degree of students' learning innovation is understood.

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