Research on Application of Big Data in the Developmental Financial Aid and Education System of Higher Education

Min Min[1,a*], Junlin Cheng[2,b]

[1]School of Foreign Languages, Jiangsu University of Science and Technology, Zhenjiang, China
[2]School of Energy and Power, Jiangsu University of Science and Technology, Zhenjiang, China

[a*]min@just.edu.cn, [b]junlin.cheng@just.edu.cn

Abstract. The emergence of big data has provided new opportunities and applications in various sectors, including education. In the context of financial aid education, the utilization of big data can enable more precise and targeted assistance. To adapt to the characteristics of the new era, universities should establish a big data mindset, create a financial aid education platform based on big data, raise awareness of data security, and integrate the use of data with a humanistic approach. By adopting a student-oriented perspective, universities can enhance the value of big data systems, optimize data utilization, and closely align financial aid education with moral education.

Keywords: big data; data analysis; precise financial aid; financial aid education.

1 Introduction

The third wave of informationization has accelerated the entrance of the big data age, and IBM has used 4Vs to define its characteristics: Volume, Variety, Velocity, and Value. With the advancement of informationization, the deep integration of information and education is the futural trend. Financial support for education is an important component of Chinese university education, and big data offers universities with technological assistance in developing a progressive financial support system for education. In 2013, General Secretary Xi Jinping introduced the idea of precise poverty alleviation, and precise financial support is an important way of poverty alleviation in education, which is a concentrated manifestation of precise poverty alleviation in education. Big data technology is critical to achieving precision during the digitalization era. According to China National Student Financial Aid Management Center, sub-department of the Ministry of Education, it is essential to actively promote digitization-supported precision financial aid, comprehensively optimize the National Student Financial Aid Management Information System, and gradually establish an integrated financial aid data application system and a functional decision making and supervision system for

data integration, mining, analysis, and sharing [1]. Financial aid and education are crucial aspects of China's higher education, and the integration of big data into college financial aid and education is a crucial strategic direction for the future.

2   Current State of Financial Aid and Education for Students in the Era of Big Data

2.1   Inception and Evolution of Big Data

In 1997, David Ellsworth and Michael Cox of NASA used "big data" for the first time [2], and in 1998, Science magazine published an article entitled "A handler for Big Data" [3]. Since 2011, big data has entered a full-blown boom period this year, and more and more scholars have shifted their research on big data from basic concepts and characteristics to multiple perspectives, such as data assets and changes in thinking [4]. In May 2012, the UN Global Pulse released a white paper on "Big Data for Development: Challenges and Opportunities", which pointed out that big data is a historic opportunity for the UN and governments alike, and that the proliferation of data science in the international arena is a powerful new tool to combat problems such as poverty, hunger and disease [5]. In December 2012, Viktor Mayer Schönberg's the Age of Big Data became popular in China, spurring the development of big data in China. The year 2013 was China's Big Data Year, with Baidu, Alibaba and Tencent each launching innovative Big Data applications, and in December that year, China Computer Federation issued the White Paper on the Development of China's Big Data Technology and Industry, which summarized the core scientific and technological issues of Big Data and promoted the construction and development of China's Big Data discipline [6]. In 2015, the State Council issued the "Outline of Action for Promoting the Development of Big Data", which comprehensively promotes the development and application of big data [7]. From 2020, as China vigorously develops the digital economy, the big data industry will enter a period of rapid development, which is closely related to people's daily lives.

2.2   Concept of Precise Financial Aid

The national requirements for undergraduates' financial aid work have been continuously improved with the development of network information technology; in 2013, General Secretary Xi Jinping put forward the important instruction of "seeking truth from facts, adapting to local conditions, classifying and guiding, and precisely helping the poor" during his inspection in Huayuan County, Xiangxi Autonomous Prefecture, Hunan Province, and put forward the concept [8]. The Ministry of Education proposed the necessity of "precise financial aid" in 2015, and the achievement of exact financial aid became an explicit aim of the state and education authorities during the 13th Five-Year Plan period. In the same year, at the National Education Work Conference, Minister of Education Yuan Guiren proposed, "we should improve the accuracy of the national financial aid policy and establish a platform relying on the national education

management information system to ensure that national financial aid, awards, and other preferential policies are actually implemented to each student who needs help" [9]. In 2017, the Party Group of the Ministry of Education issued the "Implementation Outline of the Quality Improvement Project of Ideological and Political Work in Higher education institutions" (hereinafter referred to as "Implementation Outline"), which proposed the work content of "constructing an accurate assistant work system with coordination and linkage of financial aid objects, financial aid standards, fund allocation, and fund distribution" [10]. In 2020, eight departments, including the Ministry of Education, issued documents calling for the improvement of precise financial support for education and the construction of a developmental financial support system [11].

2.3   Application of Big Data in Accurate Financial Aid

Traditional financial aid work suffers from a lack of precision and scientificity in the identification of disadvantaged students, and the financial aid management mode is backward and lacks dynamic real-time management. Big data has the qualities of authenticity, big volume, variety, high speed, concealment, and visualization, which may effectively achieve the correct identification of students with financial challenges and their degree of difficulty. The Implementation Outline explicitly proposes "adopting home visits, big data analysis, and face-to-face talks" to precisely identify pupils with financial difficulties in their families. Some researchers propose that the idea, technique, and technology of big data be used to the whole process of financial aid work to increase the degree of refinement of the content, personalization of the program, and precision of the efforts.

   With the promotion of Internet and big data technology, universities have been exploring the application of big data to financial aid education. Wuhan University uses big data technology to improve the effectiveness of accurate financial aid education, and builds a four-stage identification model of "information collection, quantitative assessment, democratic evaluation and verification" based on the establishment of a database network [12]. Wu Chaowen analyzed all of Chongqing University of Posts and Telecommunications' campus data from September to November 2015, based on 5593 poor students' campus ID card consumption information, and analyzed three indicators, such as the number of meals, average meal amount, and meal amount fluctuation, to obtain the consumption characteristics of poor students, as shown in Figure 1 to 3 [13]. By examining poor students' meal consumption levels, researchers may enhance the indicators of poor students' identification.
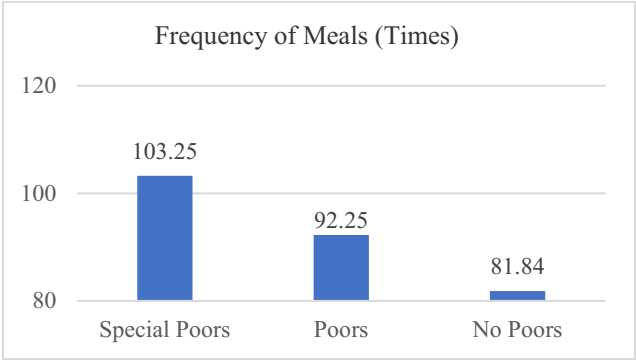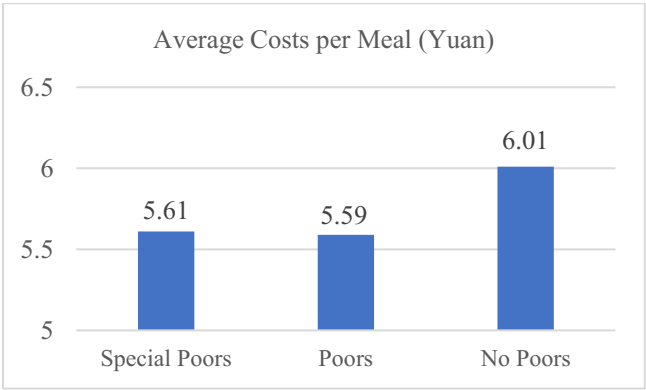
Fig. 1. Frequency of Meals

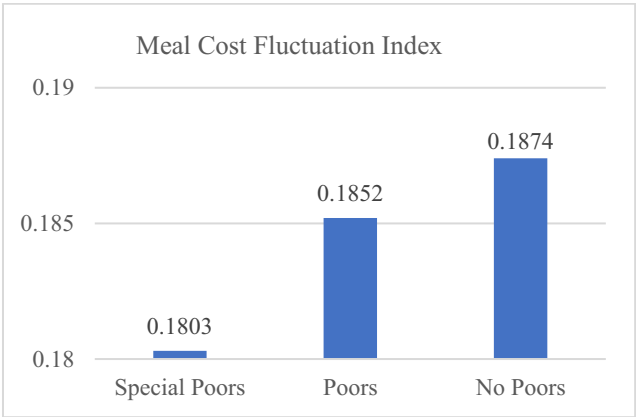
Fig. 2. Average Costs per Meal

Fig. 3. Meal Cost Fluctuation Index

3   The Importance of Building a Developmental Financial Support and Education System for College Students

The "Implementation Outline" proposed the work of establishing a developmental financial aid system with four elements: state funding, school awards, social donations, and student self-help, requiring innovative forms of financial aid for nurturing people and implementing the developmental financial aid action plan. The Ministry of Education Department of Ideological and Political Work proposed the objective of "precise political education" in 2023 [14]. The vital part of "precise political education" and "precise financial support" is the developmental financial support system. The establishment of a financial aid and education system is a crucial condition for the execution of moral education in China, according to national education task. The developmental financial aid education system is a requirement of the times to achieve Chinese modernization, according to the perspective of China's modernization building project.

4   Strategies for constructing developmental financial aid education system for college students in the background of big data

With the advantages of massive data and rapid calculation, big data is commonly applied in the financial aid education system, which is an important technical support to build the developmental financial aid system students. Figure 4 illustrates characteristics of Big Data-based financial aid education.
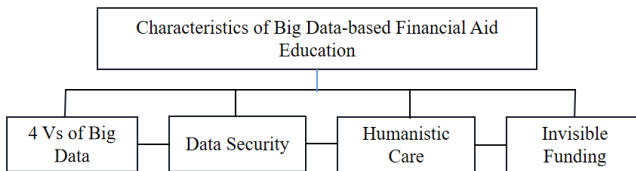

Fig. 4. Characteristics of Big Data-based Financial Aid Education

4.1   Establish Big Data Thinking and Big Data-based Financial Aid Education Platform

Big data is a cluster of data whose size exceeds the size of traditional databases for grasping, storing, managing, and analyzing, which has had a significant impact on the economic development of human society, social governance, state management, and people's daily lives [15]. Currently, accurately identifying poor students is a prerequisite for financial aid and education, and the utilization of big data in financial aid work can efficiently improve the accuracy and efficiency of this work at colleges and universities. Firstly, colleges and universities are actively adopting the big data platform to provide precise assistance to poor students. For instance, the Student Financial Aid

Management System of Jiangsu Province is utilized by all universities in the region. As depicted in Figure 5, this system enhances collaboration between teachers and students. Within the "System Management" section, teachers can swiftly review information concerning financially challenged students, ensuring their timely inclusion into the database. Moreover, the "Statistical report" feature allows teachers to access and monitor data on students facing significant difficulties in their education, as well as those who have received subsidies in previous years. This functionality enables teachers to track the subsidy status of students with special needs in real-time efficiently.
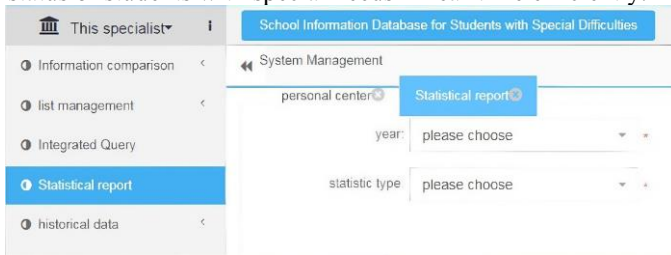

Fig. 5. Student Financial Aid Management System of Jiangsu Province

4.2   Strengthen Data Security Awareness and Unify Data Use with Humanistic Care

With the widespread use of big data, data security has become a significant concern. When integrating big data into financial aid processes in colleges and universities, it is crucial to balance preserving students' privacy with using data responsibly. Firstly, institutions should leverage big data to analyze students' daily spending patterns and other information to identify "invisible poverty" in real-time, thereby providing the most effective assistance. Secondly, establishing a robust management system can enhance data security by clearly defining the authority and scope of data usage, thereby preventing unauthorized access and excessive data mining of student information.

4.3   Insist on Student-oriented and Improve the Value of Big Data System

One of the characteristics of big data is low value density. To provide accurate financial aid in higher education, institutions should use multi-dimensional data to enhance the value density of big data. In this scenario, it is essential for institutions to do well in collecting and screening the initial data that are closely related to the learning, life and behavior of poor students, so as to enhance the value density of the data system. The first step is to collect high-quality initial data. For accurate decision-making, precise information is inevitable. The statistical accuracy of the data determines a scientific approach to analytical thinking. Therefore, we should collect basic information on the family income status, poverty causes, family composition, and other related data for all underprivileged students from the start of their enrollment in the university. This data forms a crucial foundation for effective future financial aid work. Additionally, it is essential to analyze and compare this data, constantly search for patterns in any changes, and extrapolate meaningful insights. Consequently, scientific data analysis is

the vital link to providing precise and reliable financial support. The effect of financial support work should be analyzed by comparing the initial data and the progressive data. When determining financial support for poor students, it is important to take into full consideration their characteristics such as their major, psychology, social concerns, and other relevant factors. Accurate financial support should be implemented based on the diversity of students' needs. To fully explore the deep law of financial support, the power of the network platform should be utilized. In the process of financial aid, it is necessary to make full use of the resources of the information sharing platform both inside and outside the university to strengthen the continuous management of the sponsored students. Considering the growth characteristics of disadvantaged students, it is crucial to analyze the data to predict their financial aid requirements, foresee the financial aid trends, explore the underlying principles of financial support and its significance in educating section.

4.4   Optimize the Use of Data and Closely Integrate Financial Aid Education with Moral Education

The intensive integration of computer technology and education is unavoidable for the future growth of education. Big data offers information technology capacity to create a financial aid education system, which is an important component of ideological and political education with the ultimate purpose of establishing moral education. To actualize moral education in the context of big data, development-oriented financial aid education is an unavoidable prerequisite. In the context of the big data age, financial aid education should be constructed on the basis of quantitative and qualitative data analysis by a professional work team in order to accomplish the unification of instrumental and value rationality in financial aid education. According to the characteristics of the school and students' developmental needs, higher education institutions should help students make up for their deficits and help them self-realize through programs and platforms based on big data to fully explore the actual situation and real demands of students in all aspects. North China Electric Power University provides an example of deeply understanding the developmental requirements of different students by implementing five types of nurturing programs, such as supporting poor students to study abroad and develop international perspectives, subsidizing poor students to continue their education and enhance their professional abilities, inspiring poor students to start their own businesses and improve their innovation and entrepreneurship abilities, and supporting poor students to participate in social practice, cultural, and educational activities that cultivate their practical abilities and humanistic qualities [16].

5   Conclusions

Chen Jing, a Chinese Academy of Engineering academician, has stated that big data is present everywhere and all times. He maintains that the real value of big data is in its driving impact, that is, the shared effect of big data on the economy, which is

represented not solely in the activities of data companies but in their contribution to the development of efficiency and quality in other industries [17]. Thus far, big data has evolved and is widely employed in China's economy, education, and healthcare. Big data is becoming increasingly significant in the framework of "precise financial aid and education" in higher education. Big data is a critical technological support for the establishment of a financial aid and education system. Higher education institutions, as the primary users of big data techniques, need to develop big data work perception and use the work platform of financial aid education based on big data; enhance data security awareness to avoid data being over-exploited and violating the personal privacy of poor students; continuously optimize work thinking; improve the value of data; and closely combine financial aid education with cultivating students.

Acknowledgment

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