Analysis of an Older Adults' Education Service Model Driven by Big Data

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Abstract— After years of economic development and social progress, China has now become an aging society. Since 2000, the degree of the population's aging has deepened. Statistics released by the National Bureau of Statistics indicate that after the 14th Five-Year Plan in 2025, the country will have more than 210 million people over the age of 65, accounting for 15% of the total population. In the future, the issue of China's aging population will become graver. Therefore, the development of education for older adults is an important aspect of the implementation of the Law on the Protection of the Rights and Interests of the Elderly. Further, it is an inherent requirement for establishing a lifelong education system and constructing a learning-oriented society. This paper discusses the development of education for older adults in China and discusses how to apply the big data technology service mode to education for this population. Exploring the existing problems related to managing education for older adults includes matching and disseminating aging information content; promoting the standardization, modernization, and rationalization of education services for older adults; and exploring the development trend of virtual endowments.

Keywords— Big data; education for older adults; service model; development thinking.

I. APPLICATION OF BIG DATA IN AGING MANAGEMENT

1. Aging health and longevity

China is rapidly becoming a deep aging society. A major issue faced by the country is using various types of big data in aging research to identify ways to develop China's public service practice and policies for older adults. The rapid development of the internet of things has produced several wearable and smart home devices that use new sensing technologies for collecting information about an individual's physical and social activities in real time and simultaneously uploading it to the device terminal or cloud. These data can help doctors accurately diagnose diseases and provide appropriate treatment plans for older adults. Further, such data can assist older adults in maintaining an independent life for a longer period, reducing their cost of care, improving their quality of life, and maintaining their dignity of life. Further, the big data generated by older adults' genetic characteristics and various biomedical indicators also provide abundant aging and pathological information for researchers of aging, assisting them in deciphering the natural mystery of human longevity.

Kestens et al. (2016) used various methods to collect information on the interactions between older adults and their environment to study the impact of the urban living environment on older adults' health. They used multi-sensor wearable devices to collect information on older adults' daily activities and geographical locations, an interactive map questionnaire to collect older adults' activity destinations and social interaction information, and a traditional questionnaire to collect older adults' subjective feelings about specific geographical location information [1]. This wealth of information facilitates quantitative and qualitative assessments of the relationship between older adults' health and their environment.

2. Intelligent education mode for older adults

Using traditional teaching service institutions for older adults, we suggest renovating the education model for older adults by utilizing existing resources and technology and allowing older adults to feel the dividends from scientific and technological developments and educational progress.

2.1. A sound education system for older adults and personnel security

Education for older adults in China mainly includes various forms and types, such as public and private education [2]. The main body of education is led and organized by governments at all levels. Various forms of education include primarily public education supplemented by scientific research institutes, colleges, universities, and social education. After years of development, education for older adults has reached a certain scale; formed a series of experiences and methods in student organizations, curriculum offering, teaching practice, and so on; and cultivated numerous teaching personnel specializing in geriatric education. Presently, a nationwide framework system of education for older adults has been formed. According to People's Daily, more than 8.1 million individuals are studying in more than 62,000 education institutions for older adults; further, millions participate in such continuing education for older adults offered as community education, distance education, and so on [3].

2.2. Artificial intelligence application technology development

Intelligent education is an educational behavior based on students' high learning experience, high content adaptation, and high teaching efficiency. In 2017, China issued the Development Plan for a New Generation of Artificial Intelligence, which proposed that "the development of artificial intelligence should be systematically planned and arranged at the national strategic level." This proposal indicates the comprehensive arrival of the era of artificial intelligence in China and provides a good macro policy environment for developing vocational education in the country [4]. In 2020, China also proposed to "accelerate the construction of [the] 5G network, data center, and other new infrastructure" to further consolidate the application and development of artificial

intelligence technology. Mobile internet, big data, and other high and new technologies should be fully utilized; education methods, education models, and education content for older adults should be constantly innovated to form the "infrastructure" of education for older adults in the new era, and the development of education for older adults should be promoted—all based on artificial intelligence technology.

2.3. Distance education platform

Presently, the distance education service platform represented by the Radio and Television University runs a distance teaching education mode to make full use of multimedia equipment and internet technology, largely resolving the contradiction between space and time and life in modern society [5]. The current main mode of distance education is primarily teaching and examination and covers the personnel of different regions. To a certain extent, this mode supplements the traditional education model. However, the degree to which the distance education platform is applied in education for older adults is not high because of students' low acceptance of new technology, hearing, vision, and other factors [6]. The innovative development of education for older adults is supported by an integrated distance education platform, and the single teaching and examination mode of distance education has changed to form an innovative resource aggregation platform—on the basis of artificial intelligence technology.

2.4. Big data technology promotes management service capabilities

Managing education services for older adults should not be limited only to data collection, sorting, and storage but also should provide accurate and in-depth services for managing education for older adults using big data technology [7]. The government and schools' managements should strengthen the development, utilization, and service upgrade of management information for older adults. Letting the data speak, obtaining feedback from the data, and then reprocessing the information to develop high-quality services are more important to managing education for older adults.

Big data statistical analysis, artificial intelligence technology, and the Hadoop cluster platform can be used to collect and process data on the online education teaching platform for older students. Further, their learning paths, including older adults' classrooms learning activities, such as square dancing, playing chess, painting, and face-to-face activities like having tea, can be assessed; activity proportions can also be analyzed. Existing school management problems can be solved by comprehensively analyzing older students' volatility and factors that influence teaching methods and then applying intelligent agent technology to the portion of curriculum requiring adjustments to develop curricula "according to students' aptitudes." Older adults' education service management system can be gradually improved and reformed by relying on big data and intelligent agent technology.

II. FUNCTIONS AND ISSUES OF INFORMATION EDUCATION IN AGING MANAGEMENT

The world today faces two trends unprecedented in human history. The first one is the digitization of society, and the second one is the aging of the population. Information technology can empower active aging. An increasing number of studies have shown that using information technology represented by the internet and social media can help older adults improve their cognition, engage in social interactions, enhance their emotional health, reduce their loneliness and depression, and others [8]. In controlled trials of computer systems designed specifically for older adults, participants reported higher levels of proficiency, comfort and self-efficacy, social support, and well-being when using a computer—relative to the control group [9]. Older adults who received information literacy education broadened and improved their access to information and skills [10].

1. Inner learning intention of older adult learners in the new era

Education informationization is the foundation of education modernization and represents the distinct symbol and important content of education modernization in our country. Driving education modernization with education informationization is a major trend in education reform and development [11]. Realizing the innovation of the education concept for older adults will inevitably lead to the reform of learning modes and teaching organizations, as specifically reflected in the following three aspects.

1.1. Satisfy the conscious presupposition of older adult learners

Presupposition mainly depends on and lies in thinking. More than two thousand years ago, the wise Greeks made a rule for geometric drawing: do not use compasses and rulers with scales for geometric drawing. This presupposition was designed to allow the mind to work in a purer form, effectively preventing it from relying on intuitive knowledge. At present, in the global networked social environment, older adult learners are gradually and consciously pursuing informal and diversified learning methods. Most have experienced the learning age of "finding" answers from books and "wanting" answers from teachers. After retirement, they are eager to become participants in the knowledge construction process—they seek involvement in the process—from understanding a problem to finding a solution [12]. Therefore, many teachers at senior universities began integrating project-based and inquiry-based learning into classroom teaching and achieved good learning results. Further, to meet the demands fueled by older students' subjectivity, teachers can start from students' actual needs to create a good learning experience. Gradually, there has been a shift in the emphasis on how the work is organized. That is, from a focus on learning activities and adjusting students' simple memory knowledge, teaching goals have changed to address students' learning of content and their individual choices of learning methods. An open, democratic, and free learning atmosphere is needed to stimulate students' motivation to cultivate their advanced thinking abilities to ensure their improvement in accordance with the self-cultivation goals preset by the students themselves.

1.2. Offer various learning activities

Today, most courses arranged by universities for older adults are specialized art courses. The connotation of art itself must be understood to provide diversified teaching activities. The prerequisite for the existence of artistic activities or artistic practices lies in the existence of time beyond material labor, which can be called leisure. In other words, the amount of leisure time is directly proportional to the possibility of engaging in mental labor. Marx stated that one of the great contributions of capital is that it "creates material elements for the development of a rich personality." [13] A comprehensive view of all spiritual products shows that the production of culture will be richer regardless of whether science, philosophy, history, literature, and many other fields of spiritual products are linked with leisure and regardless of the era that creates more leisure. In this new era, people have shifted from material pursuits to spiritual production. When the accompanying information technology entered the senior university classroom, the forms of the learning activities became unprecedentedly rich. The interactions in the cloud between offline classrooms and online learning platforms have become the main modes of new classroom construction. The new classroom breaks through the time and space limits and provides various learning activities that help meet the personalized learning needs of older adult learners. This new classroom satisfies older adults' desire for learning and promotes the lifelong learning concept that learning can occur for everyone, at any place, and at any time.

1.3. Focus on interconnections between knowledge units

In a digital economy that is evolving into an intelligent economy with artificial intelligence as its core driving force, older adults must cultivate their skills and literacy without the support of an intelligent learning environment, information-based teaching concepts, and media learning content—in particular, "learning content" that is key to the cultivation of the digital elderly. The learning content is more of a focus on knowledge of the information age and the connection among the units and is not confined to the knowledge unit between itself and the unit of knowledge. The knowledge network via the internet represents the main learning content, and the learning content no longer represents the traditional sense of teaching material. Instead, the learning content has a stronger network and social characteristics and focuses on the deep integration of knowledge content between different disciplines to enable learners to improve their comprehensive ability to solve problems by applying and mastering higher-order skills [14]. For example, art education starts as being relatively independent and then can fuse with technology, physics, English, literature, tea art, music, dancing, and subject knowledge to help older adult learners better understand the correlations among knowledge, professional knowledge, and being endowed with a deep connotation. This can allow the rich connotation of older adult learners' improved dialog with professional knowledge.

2. Problems faced by information technology integration education innovation

During the epidemic's prevention and control period, information technology has been widely used in the education of older adults in China. However, a gap exists between education based on information technology and the level of education's deep application and integrated innovation in developed countries. At present, China's education for older adults has entered a stage of high-quality development, and various problems and challenges have been highlighted—the crux of which is the lack of objective understanding of contemporary older adult learners. In the case of older adults who live and study in a digital environment after retirement, adaptation to the new teaching environment depends on the content, which must be urgently studied by older adult educators.

2.1. Differences in learning interests generated by different learning content media

Currently, various universities for older adults use different learning content carriers. Paper and electronic content media are more common. The difference between the two is that paper media is relatively static and in line with the living habits of older adults. Electronic media is relatively dynamic and has functions such as playing and reading, but these may cause problems for older adults with eye diseases or hearing impairments. However, whether the content and media are properly matched directly affects the learning interest. For example, during the epidemic's prevention and control period, students at senior universities took online professional art courses (e.g., art, music). During the learning process, researchers found that the breadth of the application of technical media in art majors was directly proportional to the differences in interest. If older adult learners are interested in media, they take the initiative to use the media, and teachers expand their knowledge of exploratory teaching. If older adult learners passively accept the media, the teacher can only instill knowledge, and the digital use gap problem is particularly prominent. Particularly in art classes, some learners are accustomed to the teacher's friendly teaching method and group chat type of face-to-face free communication learning environment. Thus, enabling older adult learners to communicate and interact in an online screen-to-screen teaching environment that utilizes teaching methods to conduct higher-quality teaching is a challenge that teachers face when organizing learning activities.

2.2. Learners expect differentiated classroom teaching in the information age

In the past, information technology was only an auxiliary means in the classroom; however, it has become an application platform. People receive information quickly through multiple information sources and quickly communicate and engage in exchanges through the network. These changes represent the guidance of continuous innovation in teaching and learning methods. However, the actual situation in a senior university is that the thinking of senior learners is fixed in an offline teaching environment. They prefer face-to-face classroom expression modes of intensive teaching by teachers and intensive questioning by students and are not used to hyperlinked resources. Additionally, because the students are obviously similar in age, intelligence, educational background, work

experience, and so on, for teachers to engage in personalized teaching in classrooms is difficult. To motivate older adult learners, teachers can only increase their use of flexible classroom time after school to guide students. General Secretary Xi Jinping has pointed out that developing education suitable for everyone should be accelerated, and ensuring that students with different personalities, interests, abilities, and potential can receive an education that meets their growth needs should be the goal [15]. Then, how can digital learning resources be used properly to support learning activities? How can different methods and strategies be adopted for different students to enable effective personalized management? All these problems challenge the effective teaching of teachers.

2.3. Teachers lack the knowledge of integrated technology teaching

Given the comprehensive spread of online courses, teachers must integrate courseware and educational resources and master increasing volumes of knowledge to make a lesson effective. Therefore, what type of knowledge structure should teachers have to offer a better online course? Before exploring this question, the basic features of education for older adults need to be considered. Education for older adults is non-formal education, which has the characteristics of individuality and flexibility. The curriculum content of education for older adults is not centered on subject knowledge but on learners. In teaching, older adults in economically developed areas are found to have rich knowledge reserves, and teachers should be able to adjust the teaching content at any time in a class. Therefore, teachers need to be equipped with the research perspective and theoretical basis (TPACK) of integrating technology teaching knowledge.

Since 2005, scholars at home and abroad have carried out theoretical and practical research on TPACK. Through research, TPACK research is generally believed to help improve teachers' ability to master and use information technology. Simultaneously, teachers' TPACK ability is also a necessary ability for future teachers [16]. According to the Circular of The General Office of the State Council on Printing and Distributing the Education Development Plan for the Elderly (2016–2020), a job training system for teachers in education for older adults will be established to support the professional development of teachers, technicians, and administrators in education institutions for older adults [17]. Presently, senior college teachers in China generally lack this aspect of competence accomplishment. Universities for older adults must rapidly train teachers with the knowledge structure governed by the TPACK framework to improve the quality of teachers' information-based teaching.

III. THE "PRECISE" WAY TO EXPLORE AND DETERMINE THE DEMANDS OF AGING

The basic meaning of "precision" is understood as fine, precise, and precise attention paid to the quality and effect of the supply of public goods and services, the meticulous process of affairs, the intensification of costs, and the performance of results. "Accuracy" refers to the accuracy of information, decision making, and evaluation. Accuracy mainly focuses on the correctness of the information and decision making in the

supply of public goods and services and pays attention to information symmetry and zero moral risk during the service supply process. A precision service is the application and deepening of the concept and connotation of precision in the field of public service. Accurate education for older adults represents the responsibility that society must shoulder in response to the appeals and challenges of the "accurate era," and accurate services should become the "natural attribute" and "prominent label" of the public service system of education for older adults.

Accurate identification means "to identify and distinguish the needs of public cultural services with scientific and effective methods and scientific and rigorous procedures for members of society with different needs, so as to accurately grasp the needs of the public and improve the supply performance." [18] Accurate identification is the basis of the construction of the old education public service system by using clear identification standards, assessment tools and demand information collection, information file management, and so on. Many methods exist to effectively analyze and absorb the demand for public services for older adluts' education, subsequent lean production, the supply of accurate and excellent management, and other links, thus laying a solid foundation.

Education for older adults should meet the lifelong learning needs of this population and implement corresponding development plans according to their learning needs. Providing such a plan can reasonably optimize the public service resources of education for older adults and improve the quality of public services of this education. The answer to the question of "What do older people need for lifelong learning?" is the primary premise for an aging society to promote the development of education for older adults. The accurate identification of lifelong learning needs directly affects the scientific and targeted construction of a public service system of education for older adults. The demand motivation theory can be followed: demand produces motivation, and motivation determines the behavior or action of the subject; that is, supply is determined by demand, and the identification of demand precedes the provision of a service. The lifelong learning needs of older adults are found to present a diversified and hierarchical spectrum, including "realistic needs" and "possible needs" and "explicit needs," and "implicit needs." Therefore, education for older adults should "establish an unimpeded demand expression channel and feedback mechanism, and unify top-down learning investigation with bottom-up active transmission." [19] Information on the lifelong learning needs of older adults is collected quickly and accurately, and the basic rights and interests of older adults' lifelong learning are actively safeguarded, laying a solid foundation for the precise production of public education services for older adults.

IV. AGING INFORMATION CONTENT MATCHING AND DISSEMINATION USING BIG DATA

During the rapid global digitalization process, the lives of older adults have begun to actively integrate to the internet, and they have become an important target group for mobile internet. The use of internet-based social media can meet the older adult population's needs to varying degrees, thus gradually leading

them to transition from the traditional media era to the mobile-intelligent new media environment.

At present, even among the urban population with a relatively high living standard, cultural level, and frequency of using new media, older adults still constitute the marginal audience of new media, and its application rate is far lower than that of other age groups. The main reasons are that older adults do not have strong adaptability to new media, the application experience of new media is not targeted, and public social services are still lacking [20].

Aging and the popularization of new media are irreversible development trends. Enhancing the information transmission function of new media among older adults in urban settings can better promote the social endowment of older adults and develop more growth space for the new media market. This paper proposes the following strategies for enhancing the function of information matching and the dissemination of new media throughout the older adult population.

1. Increase penetration rate of new media applications

The popularization of new media applications is the foundation for improving information transmission efficiency. Because older adults have more leisure time, they also have an internal demand to obtain information through new media and represent a potential audience of new media information dissemination—and one with the strongest loyalty. The popularity rate can be improved in several ways. First, society should strengthen the guidance and publicity of new media applications for older adults, eliminate their rejection of new media psychology, and encourage its use among them. Second, training on new media technology must be strengthened for employees of relevant social service institutions that help improve older adults' media literacy and their ability to apply new media technology. Third, new media application teaching courses can be opened or lectures on new media applications in urban communities can be held where groups of older adults gather, such as universities for older adults and community schools; thus, older adults can be helped with mastering new media application skills through one-to-one assistance from volunteers. Finally, urban communities can hold family-oriented activities on the application of new media to encourage their children and grandchildren to guide older adults with such applications.

2. Enhance pertinence of new media product application

Hardware development that addresses the physiological characteristics of product designs for older adults—smartphones and computers with larger keys, voice intelligent operations, louder volumes, larger fonts, and resistance to wear and tear and drops—can meet their demands. Moreover, relatively modest prices can also encourage older adults to purchase and operate such devices. In terms of software, the principles of simplicity, quickness, clarity, and individuation should be adopted to ensure that pages and apps are concise and clear, operational steps are simple, images and texts are high definition, and a commonly used information list is available to reduce the operational difficulties faced by older adults.

3. Increase variety and usefulness of information

Personalized information for older adults should be enhanced. Health information, such as increasing older adults' attention, can be provided to local health departments for integrating urban hospitals' information for health care and nursing purposes. Green channels can be opened for communication with drugstores that have a drug reimbursement directory for online bookings and online expert consultations for the convenience of older adults who need to visit a doctor. Providing health care knowledge and guiding older adults can prolong their lives by, for example, increasing available health care information, cooperating with local hospitals, and offering daily health advice, especially for common chronic diseases, such as hypertension, coronary heart disease, diabetes, gout, bronchitis, and so on. Increasing information on culture, art, and tourism and cooperating with local aging committees, cultural departments, and tourism departments can assist older adults in enriching their spiritual and cultural lives. Considering the availability of various information types, the authenticity and practicality of information should be ensured. Further, the content of advertising promotions should be strictly controlled to avoid false and fraudulent information and improve the credibility of the delivered content through cooperation with local market supervisory departments, public security departments, financial departments, and communication companies. Additionally, information content can be provided promptly to protect older adults from fraud and other criminal acts.

V. EDUCATION SERVICES FOR OLDER ADULTS AND DISSEMINATION OF MATCHING INFORMATION

Information media have become important ways for people to obtain information, given the development of information technology and the popularity of smartphones [21]. The dissemination of information among older adults cannot keep pace with the development of the times, particularly the rapid development of the internet. "The elderly, who have grown up in the era of traditional media, have a high degree of trust and loyalty to the media, but the media does not pay enough attention to them. In the design of new media products and communication strategies, traditional media pay more attention to how to catch up with young users. Most traditional media treat old users and young users equally. In new media platforms, there is still a lack of truly specially developed products or specially produced content for middle-aged and elderly users," [22] making it difficult to meet the needs of older adults.

Addressing the shortcomings of information transmission to older adults represents complex systematic engineering that must be solved using a systematic method. First, solving the information dissemination problem for 250 million older adults—a great people's livelihood project—must provide excellence in the top-level design and with upper departments' direct follow-up, and this project must be planned and arranged scientifically. In particular, new media should be regarded as the "sunrise industry" in the silver industry and must develop policies and financial support to give an increasing number of older adults the opportunity to "connect to the Internet," learn to use new media, improve coverage of all media construction,

and provide equal opportunities to effectively use all media. In addition to the construction roadmap, specific implementation departments and operational plans, special fund investments and support, and professional information personnel must be provided to undertake this work. At this time, the education service industry has become important to older adults' learning and familiarization with the use of new media.

1. Make good use of WeChat, exchanges, and interactions, and promote community education for older adults to share information

The internet has rapidly become popular, and the scale and popularity of internet users are growing rapidly. According to the 44th Statistical Report on Internet Development in China, as of June 2019, the number of internet users in China reached 854 million, the internet penetration rate was up to 61.2%, and the number of online education users reached 232 million, representing the type of application with the highest user growth rate as of the first half of 2019. Given the development of various smart terminal devices, the number of mobile internet users has reached 847 million, and 99.1% of internet users use mobile phones to surf the internet. Further, the proportion of internet users over the age of 50 years increased to 13.6%. Internet new media technology continues to penetrate the middle-aged population. An increasing number of older adults have their own mobile phones, and WeChat is widely used. This new situation should be leveraged, and actions can be taken in accordance with the trend to enable WeChat to serve older adults' education in the community. A community education WeChat public number can be used to open up a new personalized learning method for older adults.

On the WeChat platform, information on community education activities can be released on time, and the results can be dynamically displayed to continuously increase older adults' enthusiasm to participate in community education. WeChat pushed the following important learning activities, resources, and other mobile learning methods: the opening ceremony of "Lifelong Learning Week for all" was broadcast live; enabling the selection of the "people's learning star" and "learning family" during voting years; selecting photographic works with the "Lifelong Learning, Happy Life" theme; and award-winning micro-course videos were developed and designed by teachers of the community college and were displayed. Through pictures, audio, short videos, and other forms of display, the market needs of "anytime, anywhere, anywhere" learning and fragmented learning of older adults are truly met, and internet education is afforded richer application scenarios. Promoting excellent learning resources has stimulated the learning interest and creativity of older adults in the community. The deeds of "learning star" and "learning family" candidates were shared and reprinted in circles of friends to enable community residents to give their thumbs up and vote for them. These efforts imperceptibly spread the spirit of excellent learners and allowed them to become role models and "learning stars" in the community, playing an exemplary role. Through the "give-a-like" evaluation of learning behavior, older adult learners in the community are encouraged to participate in learning enthusiasm and initiative and strengthen self-confidence. The use of WeChat has changed the isolated and passive learning mode and has created a benign learning atmosphere of social interaction and mutual learning.

2. Offline experience, online learning, and improving the effect of hybrid learning

According to an analysis of older adults' learning needs in the community, the community college determines the theme of "enjoy education and a happy life" and conducts a "Public interest and Hobby Training class" with a focus on the publicity and popularization of basic life knowledge, health literacy, and scientific information literacy. The community's older adults can master basic healthcare knowledge, develop good study habits, and improve their information literacy and comprehensive quality through the provision of "smart phones, tablets, electronic photo albums, and ability to make short videos," "scenes that teach you how to make pastries," "family common flower culture art," and "online shopping." Using such menu-styled training, teachers offer lectures, use educational information teaching means, make excellent PPT speeches, make onsite teaching activities more vivid, and improve learning efficiency. Through courses such as "I will easily teach you online shopping," "learn smart phones, tablets, computers, electronic photo albums, and short video production," and other mobile internet courses, the number of participants improves, and the atmosphere becomes active.

Community colleges make full use of new media technology to implement hybrid learning methods that closely integrate online video and offline experiential learning. Attention must be paid to providing high-quality course resources, and digital learning resources can easily stimulate older adult learners' interests. Therefore, resources must be carefully organized to decompose all knowledge points that need to be linked to form a whole that affects older learners' logic and thinking abilities. Teachers should be encouraged and organized to actively conduct micro-course training, studies, and exchanges, independently develop micro-lesson videos of digital learning resources for community education, and use the online network terminal of citizen learning, mobile terminals, and the official account for community education. Such micro-courses, including "Learning Network with Sun Tasheng" (series of 10 micro-lessons), "Advanced Application of Efficient Office Excel" (series of 10 micro-lessons), "Understanding QR code," and so on, popularize new media technology. Other micro-courses address ways of thinking and psychological emotional regulations, such as "Balam Donkey Thinking," "Halo Effect," "Why the Rich Get Richer and the Poor Get Poorer –The Matthew Effect," "Herd Effect," "Emotion ABC," and micro-courses that use local humanistic resources, including "Regional Culture: The Making of Watermelon Lamp," "Zhapu Special Snacks: Shrimp Cake," "Xincang Eyebrow Dumplings," and so on. These courses are deeply loved by older adult learners in the community, and mixed learning deepens the experience and reflection to meet the needs of personalized learning.

VI. EXPLORATION OF "VIRTUAL PENSION" USING BIG DATA

"Virtual endowment" is a smart home-based care service model that addresses old-age problems. By using internet technology, older adults can enjoy various effective services similar to institutional care through traditional home-based care, making it an effective integration of the "fragmented" supply of old-age care services. Virtual nursing homes, known as "nursing homes without walls," are an innovative form of "home care + elderly support service." [23] Initially, virtual nursing homes could only seek help through telephone calls. Recently, given the development of intelligent technologies such as the internet and the internet of things, the realization carrier of virtual nursing homes has been expanded; further, the pension service platform built using intelligent network technology has become the main form. This platform can effectively integrate pension resources, such as pension institutions, community service centers, and housekeeping services, through government guidance and the participation of enterprises and social pension institutions.

In 2007, Canglang District, Suzhou City, Jiangsu Province, took the lead in proposing the concept of a "virtual nursing home" and established a "neighborhood" virtual nursing home. Subsequently, Lanzhou City in Gansu Province and Zhangjiagang City in Jiangsu Province actively explored and established a unified regional information service platform for older adults. When older adults have service needs, they can call the platform, which will arrange onsite services for enterprise employees. This pension model "greatly reduced the per capita pension cost for the government to bear the pension responsibility"; however, at that time, given the lack of technical capacity and a weak enterprise market and social organizations, "virtual nursing home" did not form an effective and widely operated pension service supply model. More than ten years have passed since the establishment of the first virtual nursing home in the Canglang District of Suzhou. Home-based nursing services under the virtual nursing home models have been implemented in many places across the country.

After more than ten years of accumulating experience, the operational rules of China's virtual nursing homes can be summarized as government promotions, market-oriented operations, information management, and professional services, indicating the characteristics of expanding service groups, diversified service content, and prominent intelligent features—but also facing a series of bottlenecks. In this regard, we should enrich the service types and provide "age-friendly" products and services. We will strengthen the ranks of service providers catering to older adults and expand the supply of professionals. A fair competition mechanism should be established to stimulate market and social vitality; the older adults' service quality evaluation system should be improved, and the government's supervision and management functions should be strengthened.

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