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EDITORIAL

A Reality That Cannot Be Ignored: China's Education for Poverty Alleviation in the Process of Urbanization

Fangmei Li

In theory, education is a booster of economic development. When the development of the two is synchronized, their mutual promotion effect will be most significant. However, in reality, the development of both sides is often not synchronized, and education is mostly lagging behind economic development needs. One of China's critical problems is that the development of the economy and education is out of balance, and the development of education is seriously lagging behind the economic level. Therefore, many unconventional education abnormalities have been derived. This is not only the inevitability of the unbalanced development of economy and education but also the final result of social self-repair to achieve a certain balance. This aspect puts forward higher requirements and challenges for the balanced development of economy and education, and at the same time, creates conditions for further in-depth reforms.■

ELIMINATING poverty is the common goal of all countries in the world, and education is one of the most important means to achieve this goal. As UNESCO Director-General Ms. Azoulay (2020) said in the 2019 International Education Speech: "Education can ensure significant improvements in health, stimulate economic growth, and promote the potential and innovation needed to build a more resilient and sustainable society. Without the political commitment to achieve the ideal of universal education, we will not be able to break the vicious circle of poverty, mitigate climate change, adapt to technological changes, and even less likely to achieve so-called gender equality."

According to statistics from UNESCO (2019), approximately 262 million children and young people in the world who cannot go to school, and about 617 million children and young people lack reading and basic math skills. In sub-Saharan Africa, only less than 40% of girls have completed middle school, and about 4 million refugee children and youth are out of school. Serious inequalities exist between rich and poor families, between girls and boys, and between rural and urban areas.

In response to the increasing global imbalance in education, UNESCO released the "*Education 2030 Framework for Action*" at the 38th UNESCO General Conference, which expanded the mission of education to inclusive, fair and lifelong learning for all, and to achieve the goal of equal educational opportunities for each individual (UNESCO, 2015). On October 17, 2019,

the World Bank included the education balance in the report and clearly stated in the "*Ending Learning Poverty: What Will It Take?*" that the global "learning poverty rate" would be reduced by at least half by 2030. In the report, "learning poverty rate" is defined as the proportion of 10-year-old children who cannot read and understand a simple story. Since then, educational balance has become one of the themes of concern to countries around the world (The World Bank, 2019).

In order to achieve the global education goals and eliminate learning poverty as soon as possible, countries have determined their national policies and adopted a series of measures (Arsani et al., 2020; Omodero, 2019; Zhang, 2020). It aims to block the intergenerational transmission of poverty through education and ensure that all children in the country can enjoy high-quality education regardless of their socio-economic background, race or gender.

For education poverty alleviation, the focus of research is more on education in resource-poor areas (Zhu, 2020). However, with the acceleration of China's urbanization process, more and more people from rural areas enter the cities to seek employment, and new education equity issues have arisen from this. These problems in China are mainly manifested in the education of migrant workers' children and the education of students in rural areas where educational resources are scarce. Focusing on these issues, Chang & Bu (2020) and Huang (2020) respectively focused on "education issues for migrant workers' children" and "China's high school and county education model under the college entrance examination system", they conducted an in-depth analysis of the education issues in the process of urbanization in China from both the urban and rural perspectives. Chang & Bu (2020) conducted a research on the compulsory education of Chinese migrant workers' children and pointed out that these children maintain the identity and status of their parents and are at a disadvantage in the overall structure of social interests. Therefore, paying attention to the education problems of this huge disadvantaged group is of great significance for promoting China's education equity and social development. The county model that Huang (2020) focuses on is a model different from urban education adopted by schools in areas with weak educational resources in China to obtain more higher education places. From the perspective of education equity, this educational model is an educational self-rescuing way under the current college entrance examination system in areas with weak educational resources in China. Therefore, the author believes that finding a new way for the development of the "county education model" is of extraordinary significance for promoting educational equity between urban and rural areas.

In the process of continuous promotion of poverty alleviation through education in all countries in the world, all countries have formed certain experiences and achievements, but new social development will inevitably bring new educational problems. How to solve new education problems more comprehensively in the period of accelerating urbanization in China should become a topic of concern to more scholars. It is a reality that cannot be ig-

nored, and it is a thorny problem that has to be solved to achieve educational equity and social stability.

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ORIGINAL ARTICLE

Not Only Survival but Stronger: The Impact of Alarming Invader of SARS-CoV-2 on Global Education

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***Abstract**: The pandemic of Coronavirus disease 2019 (COVID-19) has caused an immeasurable impact on most countries and regions globally, especially in education. The shutdown of schools and classes in most countries and regions from pandemic has greatly affected education in the fight against COVID-19. The implementation of large-scale online education has also exposed global education's status quo and psychological and social problems. Based on the review of related studies, this paper analyzes the impact of the COVID-19 pandemic on education to further think about educational reform's direction and path.*

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Introduction

THE outbreak of Coronavirus disease 2019 (COVID-19) at the end of 2019 spread to all parts of the world at an unprecedented speed, becoming the first global pandemic in more than 100 years, causing severe harm and threat to human lives (WTO, 2020). However, the pandemic's impact has far surpassed the medical and health fields, and the impact and destruction on the economy, politics, culture, education, and ideology are even more incalculable.

Education is one of the areas most affected by COVID-19 pandemic. With the spread of the pandemic, most countries and regions worldwide have temporarily shut down schools and other educational institutions to curb the spread of COVID-19. According to the "*Education Policy Briefing during and after SARS-CoV-2 Pandemic*" released by the United Nations in August 2020, the COVID-19 pandemic has caused the most severe damage to the education system in history. It has affected more than 191 countries and regions worldwide to close schools and educational institutions, and 94% of school students worldwide have been affected. In low-income and low-middle-income countries, this proportion is as high as 99% (United Nations, 2020).

While this sudden pandemic has triggered a global education crisis, it has also forced governments, schools, and teachers of all countries to take the initiative to intensify educational reforms. Many countries and regions have accumulated much valuable experience in school management and system innovation, teaching methods and content innovation, teacher education, etc., which have become the basis for responding to the COVID-19 pandemic and further educational reform and development in the future. Based on reviewing related studies, this paper summarizes the educational problems exposed in the pandemic, discusses the educational development during the pandemic, and then comprehensively analyzes the pandemic's impact on education, aiming to realize substantial educational reform and make it more vital than ever.

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COVID-19 Pandemic Has Wreaked Havoc on the Global Education System

The COVID-19 pandemic has caused education disruptions in most countries and regions around the world. At the peak of the pandemic in April, according to the official website of UNESCO, the governments of 113 countries/regions around the world have announced or implemented measures to close educational institutions to slow the pandemic's global spread. Among them, 102 countries have implemented national school suspensions, which have caused nearly 1.6 billion children and young people worldwide to be unable to continue their studies in schools. Also, 11 countries have implemented partial suspension policies; if these suspension policies are implemented nationwide, tens of millions of students will be affected by education disruption (UNESCO, 2020A). According to UNESCO, the disruption has affected the education system at all levels, from pre-school education to higher education, and the impact has far exceeded the scope of school closures (UNESCO, 2020B). In the "Education and COVID-19 Policy Brief" released on the 4th, UN Secretary-General Guterres stated that COVID-19 had caused the most significant damage to history's education system (António Guterres, 2020).

Global Education Quality and Students' Academic Performance Decline

In Hattie's comprehensive report of more than 800 meta-analyses on academic achievement, the relationship between learning time and academic achievement is analyzed, and it is found that the time invested in learning tasks is directly proportional to the learning achievement (Hattie, 2015). Affected by the pandemic, education was interrupted for up to five months, and students' time in their studies was forced to shorten. Nearly 7 million elementary and middle school students are forced to drop out (The World Bank, 2020). This will inevitably affect the global education and learning level.

The Learning Time for Youths Has Been Shortened

The ILO's report on the impact of the pandemic on young people released on August 11, "Youth & COVID-19: Impacts on jobs, education, rights, and mental well-being," stated that since the beginning of the COVID-19 pandemic, globally, more than 70% of young people who are going to school or integrating industry and academia have been adversely affected by COVID-19 pandemic, and 65% of young people said that the length of their studies has decreased since pandemic occurred. The report also showed that most young people's learning shifted from offline to online and remote during the

pandemic period. Half of them believed that their studies would be delayed, and 9% believed that their studies might be abandoned halfway (IOL, 2020).

In the report of Azevedo and Hasan et al. (2020), students worldwide' significant study time is predicted based on the shortening of school time. The report stated that students completed an average of 11.2 years of schooling before the crisis during the entire school age. Considering learning quality, a primary education's practical education period of young students is 7.9 years. However, due to the occurrence of COVID-19, school closures for 5-6 months will cause students to immediately lose 0.6 years of school education, thereby reducing the sufficient period of children's primary education from 7.9 years to 7.3 years.

The Quality of Students' Studies Has Declined.

With the shortening of learning time and the transformation of learning methods, the quality of students' academic work will inevitably change accordingly. Especially in the home study stage, the difference in students' autonomous learning ability will have a crucial effect on learning quality. Students with low self-control ability will have worse learning effects after returning to school and accepting regular classroom teaching (Xiao & Li, 2020).

In the study of Sintema (2020), students' academic performance in a public high school in Chipata District, Eastern Province of the Republic of Zambia, was investigated. According to the study, due to the reduction in Zambian middle school students' school time and the lack of e-learning facilities or lower levels of information, students' pass rate may decline if the Zambian Examination Board does not postpone the national examination date.

Fordjou et al. (2020) used quantitative research methods to investigate 214 students in the second and tertiary institutions in Ghana, West Africa. The survey results showed that due to the COVID-19 pandemic, students had encountered some challenges when they leave school to study, such as the online learning system's ineffectiveness and students' low ability to learn independently. Even most Ghanaian students could not access the Internet and lack relevant technical knowledge, and the e-learning platform launched thereby posed a challenge to most students, and the quality of students' learning during the COVID-19 pandemic had declined.

China was the first region to implement "School is Out, But Class is On," and the survey results on student performance during home study further confirmed this point. Dai & Xia (2020) and Xie (2020) studied the learning effects of students during the pandemic period from the perspectives of online education and independent learning; it was concluded that whether it is online learning on the platform or under the guidance of teachers, autonomous learning had a specific effect on students' learning. However, compared with the prior pandemic level, students' academic performance has a more obvious decline.

The Student's Mental and Physical Health was Impaired

Full-time school education not only provides courses for students, but it is also the beginning of the student's understanding and contact with society, and its social nature cannot be ignored. Prolonged school closures meant that interactions between students and peers and students and teachers were interrupted. There is evidence that when children are out of school (such as weekends and summer vacations), their physical activity is weaker; they sit for more extended periods, eat and sleep irregularly, which leads to weight gain and loss of cardiorespiratory fitness (Brazendale et al., 2017; Wang et al., 2019). If children are confined to homes without outdoor activities and interaction with friends of the same age during the outbreak, the adverse health effects may be more serious.

Compared with the damage to physical health, the mental health of adolescents may be more easily overlooked. After all kinds of disasters occur, they will affect their mental health, and some may even cause long-term developmental damage. In severe cases, they may cause Acute Stress Disorder (ASD) and Post-traumatic Stress Disorder (PTSD) (Veenema & Schroeder-Bruce, 2002), as well as a series of other reactions, including grief, depression, sleep disorders, and other health effects, as well as some unusual reactions of children such as deliberate tantrums and increased attachment (Madrid et al. 2006). Especially under the influence of COVID-19, teenagers have been in a state of family confinement for a long time, lack face-to-face contact with classmates, friends, and teachers, and the stress lasts for a long time, which may have a more lasting negative impact on them (Wang et al. al. 2020).

Wang & Hegde et al. (2020) conducted interviews with 195 students from a large public university in the United States to understand the impact of the epidemic on their mental health and well-being. The survey results showed that the COVID-19 pandemic has a considerable negative impact on various academic, health, and lifestyle-related results. In particular, the COVID-19 outbreak has increased stress and anxiety, including fears and worries about oneself and loved ones' health.

A similar study (Orgilés et al., 2020) conducted in Spain and Italy examined how the COVID-19 outbreak affected children's well-being based on a survey completed by 1,143 parents of children aged 3 to 18 years. Compared to before the lockdown, a large percentage of parents (85.7%) perceived changes in emotions and behaviors of their children, especially difficulties in concentration (76.6%) and boredom (52%). About a third of the sample reported that their children during the home confinement were more irritable (39%), restless (38.8%), and nervous (38%), and felt loneliness (31.3%) and uneasiness (30.4%).

Besides, the reduced social interaction due to physical alienation has also become one reason college students feel stress and anxiety. This conclusion appears not only in the United States but also in previous surveys conducted in Spain, China, Nige-

ria, and other countries (González et al., 2020; Quan, 2020; Rakhmanov & Dane, 2020).

Exacerbated the Inequities of Global Education

Due to schools, universities, and training centers' closure, students' learning, especially education in low areas, faces tremendous challenges. The ILO's August 11 Communiqué also explained the increasing phenomenon of global education inequity. They believed that 65% of young people in high-income countries are eligible to receive video teaching, while only 18% of young people in low-income countries could learn online for a long time. Therefore, compared with middle- and high-income areas and families, the pandemic had a more severe impact on youth education in low-income countries (IOL, 2020).

The World Bank report also pointed out that before the COVID-19 pandemic outbreak, the world was already struggling with the in-depth learning crisis. 53% of children in low- and middle-income countries could not read and understand simple texts before the age of 10 (The World Bank, 2019). With the spread of the pandemic, prolonged suspension of education will prevent students from implementing a significant learning process and lead to the reversal of learning outcomes. This will produce more severe educational inequities, especially for those students who have special/diversified educational needs due to their qualifications, family financial level, etc. Such groups may not be able to deal with distance learning strategies or obtain useful information effectively. Therefore, countries will face more challenging issues, including educational inequity (The World Bank, 2020).

The World Bank also stated that dropouts and loss of family livelihoods caused by the COVID-19 pandemic might make girls particularly vulnerable and exacerbate exclusion and inequality, especially for the disabled and other marginalized groups.

Pandemic Affects the Mobility of Global Education

In addition to the impact on primary education, the pandemic has caused unprecedented large-scale disruptions in global education flows. Many schools said that even if pandemic tends to ease, they still decide to continue to teach online after school starts for safety reasons. For example, the University of Cambridge in the United Kingdom announced that all massive public courses in the 2020-2021 academic year would be changed online. The California State University system will continue online teaching in the fall semester of 2020, and the campus will remain closed (Tu, 2020). The pandemic's comeback or the new virus's mutation may block open communication in traditional space and time at any time.

Have an Impact on the Academic Performance of International Students

Data from the Organization for Economic Cooperation and Development (OECD) showed that the number of international students studying in higher education worldwide had increased substantially in the past few decades, from 2 million in 1998 to 5.3 million in 2017 (OECD, 2020). Among them, UNESCO's data showed that 2.5 million people study outside their home countries. These large groups of overseas students could not return to campus on time due to travel restrictions imposed by many governments in 2020, or they have to leave campus during the closure of universities and colleges. Although many institutions provide online courses for students, students who participate in online learning still evaluate and certifiable learning results.

It Hinders Academic Exchanges between Countries in the World

The COVID-19 pandemic has the most significant impact on the academic community, and many studies on non-COVID-related topics have been put on hold. In the United Kingdom, the National Institute for Health Research Funding has stopped all non-COVID research from bringing clinically trained personnel who are usually academically seconded back to the front line (National Institute for Health Research, 2020). In the United States, the National Institutes of Health has taken similar actions to close all non-critical research to free up personnel and resources for "critical" research (National Institutes of Health (NIH), 2020). In addition to health care research, Harvard University closed research in fields such as the humanities and social sciences and closed all laboratories in the School of Arts and Sciences (Harvard University, 2020).

Scholars have also raised concerns about the number of canceled or postponed scientific conferences (Impey, 2020). Cranford, Editor-in-Chief of *Matter magazine*, said that starting from March this year, the planned APS March Meeting and American Chemical Society (ACS) meetings were initially canceled or delayed (Cranford, 2020). These conferences are the key to scientific research in many disciplines. They can disseminate research results and provide networking opportunities for collaboration and job hunting. Many conferences have been conducted online, but these "virtual conferences" are usually unsuitable for networked and informal means of scientific communication.

Have a Huge Impact on Education and Training Institutions

As one of the supplements to school education, shadow education has always occupied an important position in education, and it has been expanded globally in recent years (Berei & Liao, 2012). In a study on the use of shadow education globally, Byun et al. (2018) proposed that about one-third of 15-year-old students from 64 countries/regions use shadow education.

However, this situation has changed dramatically after the COVID-19 pandemic. According to a 2020 survey report on the status of the global off-campus training and education industry during the pandemic period by the Training and Education Professional Committee of the China Private Education Association, the results show that over 90% of the institutions said that there was a significant impact on the pandemic. There are some or severe difficulties in the operation of the organization. Among them, 29% of institutions said that they had "severe impact" and that their operations were facing severe difficulties and might go bankrupt; 36.6% of institutions said that they had "a great impact" and their operations were temporarily stagnant; 25.4% of institutions said that the impact was enormous and their operations had some difficulties. In a barely maintained state, 7.9% of the institutions said they had a "small impact," and their operations remained stable despite difficulties. Only 1% of institutions stated that pandemic has no noticeable impact on business activities (China Private Education Association Training and Education Professional Committee, 2020).

It is not difficult to find that the current education and training industry is mostly offline training, and offline training institutions mostly use the offline small class teaching mode, which will inevitably involve more personnel gathering. When a pandemic is not fully controlled, and protective materials are insufficient, offline education and training institutions are under pressure. At the same time, offline education resources mostly came from tutors and contracted teachers. Therefore, pandemic impacts the traditional business model, and companies need to bear the rent, teacher fees, and courses that violate the agreement.

During this period, some companies began to make online transformation attempts, using cloud video conferencing to conduct small-scale online teaching or try to live teaching and other forms. To a certain extent, promote the online transformation of training institutions and provide digital power for small and medium training institutions. However, in the real environment, many offline training institutions lack complete equipment or sufficient financial support. Online transformation is facing huge problems, and it needs to face the market competition of large online training institutions. They lack the technology and relatively skilled operation ability, and online mode attempts are a big challenge for training institutions.

COVID-19 Pandemic Has Given Birth to New Changes in Education and Teaching

When facing the destruction that pandemic brought to education, we also saw the other side of its impact. To better respond to the education crisis, governments of countries

have strengthened the education system's resilience and strengthened risk management capabilities by vigorously emphasizing equity and tolerance. This is the pandemic that gave birth to new changes in education and teaching. It will make global education stronger in dealing with Isudden crises.

Form a New Understanding of Education

The core goal of modern education has always been to "teach all knowledge to all people, "and the goal of knowledge-based teaching is to allow students to "learn" knowledge and skills (Li, 2015). With the integration of technology and education, students' ways to acquire knowledge have become more diverse. Schools are no longer like classrooms defined as imparting knowledge to students in the traditional concept, but more to teach students to think independently. Cultivate students' global vision and social responsibility in school education, and promote students' proper all-round growth. This pandemic helped people redefine school education goals and tasks, powerfully interpreted what kind of people to train, and established correct educational values.

During the pandemic period, the school and the family, teachers, and students are passively separated in space. While online education breaks the time and space limitations of traditional education, it also leads to some inevitable shortcomings of its own. The most important one is that online education has higher requirements for students' autonomous learning ability due to lack of supervision. In a report on online teaching research in China, in response to students' online learning problems, 37.1% of the 33,240 survey respondents believed that they were less active in online learning, while 45.8% of students said they need the supervision of teachers and parents to complete the task of online learning (Wang et al., 2020).

Online education has forced schools and teachers to pay more attention to students' learning while imparting knowledge. Teachers become learning guides and advisers, and students must master how to learn independently. When students return to campus again and school education restarts, we must further reflect on the nature of future teaching goals. We should gradually clear that the achievement of the goal of "mastering" knowledge is only the basis of future teaching, and higher-level teaching goals are to teach students the method of "learning" and the motivation for "active learning" (Rapanta et al., 2020). School education should focus on knowledge and focus on developing students' abilities, emotions, and character and focus on the cultivation of students' core qualities. Teachers should always guide students to summarize and share learning experiences, gains, and experiences, to enhance students' awareness of self-learning management and form active learning habits.

Further, Improve and Perfect the Teaching Contents

The primary basis for judging whether the content of education is proper is to see whether it prepares for a complete and satisfying life. Thus, Spencer (1884) ranked the

importance of knowledge in life and ranked first as the knowledge that directly contributes to self-preservation and knowledge that can indirectly contribute to self-preservation by obtaining life necessities. In school education, we pay more attention to subject knowledge while ignoring the knowledge people should have in life and development. For this reason, after the pandemic broke out, schools have reorganized their teaching content with life as the core, constructing life-oriented education content, and teaching students the life skills they need in the future.

Increase the Content of Health and Life Education

COVID-19 poses a severe threat to people's lives and health. According to the data from WHO presented on October 28, 2020, the pandemic has caused more than 1.16 million deaths (World Health Organization, 2020). The significance of life education is to help students gain knowledge of life and cultivate students' attitudes towards life. Education should see the value and meaning of life and teach students to face death, respect life, and value health.

In recent years, certain developments have been made in life education. More people have seen that death education will be closely related to history, Art, biology, philosophy, health education, war, genocide, life cycle, and biodiversity loss (Wass, 2004). However, most countries and regions do not include life education in their curriculum plans or endow them with any educational value (Herr án et al., 2019).

Due to the deaths caused by COVID-19, adding life education to school, curricula have become an urgent task for schools. Due to the high proportion of COVID-19 cases and deaths in the United States, more schools recommend that death education be included in school curricula (McAfee et al., 2020; Rodr guez et al., 2020).

Besides, courses to increase health knowledge about pandemic prevention have become one of the hard works of schools after the pandemic. Cahapay (2020) believes that in the later stage of pandemic normalization, schools need to specify disaster preparedness (disaster recovery) goals, especially in higher education, to expand the role of health maintenance in responding to global infectious disease outbreaks (Corless et al., 2018).

Now, almost all governments and education departments provide students with guidance on epidemic prevention and take appropriate measures to avoid infection or deal with it after infection. Health education, especially education-related to sudden disasters, will become an integral part of school curricula in the future.

Pay More Attention to the Improvement of Students' Information Literacy

Before the COVID-19 pandemic, "digital school" has been a concern for education in all countries. In the research of Iivari et al. (2020), the digital divide is raised to the basis for students' younger generation's survival and development. They believe that the

school plays a pivotal role in empowering the younger generation of students to actively create and shape digital technologies, accept extensive digital transformation, and satisfy the younger generation and their digital future. However, the school's existing resources and abilities, including technologies, culture, practice, skills, and abilities, as well as their values, attitudes, identities, and mentality, are considered barriers to digital transformation (Vial, 2019), and there are fewer in school education Emphasize the improvement of students' information literacy as a basic curriculum. For example, the 2018 International Computer and Information Literacy Research Report (ICITS) (Fraillon et al. 2019) and surveys conducted in other European countries (Autorengruppe Bildungsberichterstattung 2020; Carlsson, 2019) showed that in European countries (such as Germany and Switzerland), the implementation and development of information and primary cation technology (ICT) in many schools lag behind people's expectations of the education system. Teachers, students, and families may not be fully proficient in applying digital learning tools to live. Therefore, the occurrence of COVID-19 pandemic may not only force school education to be interrupted but also a situation where students' digital ability affects the learning effect (König et al., 2020)is context, in July 2020, in the video conference on China's education informatization work, the Chinese government puts the improvement of education informatization literacy as a top priority. The meeting pointed out that nanotechnology, virtual reality, and artificial intelligence constitutes the future world. The "uncertainty" and "variable" of the future exist all the time. Facing the future of the information revolution, continuous improvement of students' information literacy is a sufficient guarantee for promoting student development and realizing education equity (Ministry of Education of the People's Republic of China, 2020a).

Subvert the Normal Paradigm of Education

Digitalization as a new technology to reform education, "survival of the fittest" manifests Darwin's theory in the education system. Naqvi & Art (2020) bluntly stated that digitalization is an essential step in education reform, which will reshape the entire education system in the future.

After the pandemic occurred, all regions and countries are organizing schools to conduct online teaching. The school organization is facing profound changes. The teaching method has been changed from offline to online. Education has achieved the most massive migration in history (Zhou et al., 2020), forming a new teaching method: blended teaching. The core of mixed teaching is how to make up for the shortcomings of the two teaching methods and online teaching and rationally and effectively combine the advantages of "Internet + education" with traditional classroom teaching. This paradigm has wholly overturned the standard paradigm of "class teaching" education and teaching, and the hybrid teaching paradigm based on online teaching "learning center" has gradually been widely accepted and recognized.

In the home learning stage, online learning is mainly presented in the following organizational forms: live broadcasting class, live broadcasting + online quality class +

learning task list, learning task list + online quality class (or self-made micro-class), etc. In the specific implementation, most lower-graders adopt the latter two forms, publishing a learning task list, plus a few minutes of micro-class video, and students can learn independently to adapt to students, parents, and society. The "learning before teaching" model, which is highly popular in the real education ecology, is widely used in elementary schools with the weakest autonomy during online teaching. This includes the test of elementary students' self-control and the exploration of opportunities for educational reform.

Taking Daxie No. 2 Primary School in Ningbo City, Zhejiang Province, China, as an example, to ensure the effectiveness of online teaching, the school uses questionnaires and telephone inquiries to grasp the learning environment's learning status of each family. By holding regular class meetings and communicating directly with all students individually, the emotional connection between teachers and students is maintained, and students' learning and psychological confusion are relieved. According to the actual situation of students from different families, various forms of online social platforms such as WeChat, QQ, Dingding, telephone, text messages, etc. are used to realize teaching feedback and to do an excellent job of learning evaluation to ensure the effect of online learning (Xie & Yang, 2020).

In Norway, Bubb & Jones (2020) examined the experiences of 1,000 home-confined students in a municipality in the Norwegian fjords. This specific municipality had invested heavily in technology, and before the home confinement period, all students were provided with a computer or a tablet. The survey results showed that a large percentage of children (88%) and teachers (80%) agreed or strongly agreed that they had become better users of digital tools during the lockdown. Furthermore, this municipality's school leaders stated they were willing to continue using online tools such as digital meetings with teachers and parents and digital tools for differentiation in teaching.

With the pandemic's normalization, the blended education mode will become the normal teaching mode for a long time. In this regard, many schools have also stated that they will pay more attention to online and offline integration and innovation even after classes' resumption. On the one hand, it is necessary to deepen the advanced teaching models and practices that have been formed before the pandemic; on the other hand, continue to make full use of the Internet to make up for the lack of classroom teachings, such as the single school education resources, independent learning and personalized learning needs cannot be met (Kong, 2020). The development trend of education is to realize the transition from actual blended teaching to seamlessly integrated education, from large-scale standardized education to meaningful, deep, and sustainable personalized education, and to construct a new paradigm of online and offline education.

Pay Attention to the Psychological Education of Teachers and Students

Studies have shown that long-term accumulated stress can cause long-term psychological distress and even trauma to some people (Boyraz & Legros, 2020). Student growth is a process of change from immature to mature. Due to unsound physical and mental development, weak self-control ability, and frequent and changeable psychological fluctuations of students, their psychology is often in the "dangerous period" and "transitional period" (Buhler, 1999). Especially when faced with some stressful life events, it is easy to have bad psychological stress. A pandemic is a specific stressful life event. Several months of home-based epidemic prevention can cause various negative and unhealthy emotions on students easily; it is also prone to social disorders such as hostility and sensitive interpersonal relationships and somatization reactions such as paranoia and sleep disorders (Tang et al., 2020). In the face of online classes, some students are uncomfortable and may also lead to problematic behaviors such as weariness and avoidance (Irawan et al., 2020). These will seriously hinder students' healthy development, so paying attention to students' mental health education has become a key topic.

After the pandemic was effectively controlled in China, schools worldwide began to resume classes in April. School teachers and students resumed from online learning to campus learning. Once again, the learning environment changes have caused all teachers and students to encounter varying adaptation problems. In order to help teachers and students pay attention to their physical and mental health and adjust their emotions, the Ministry of Education of China and the National Health Commission have issued "*Twenty Questions about Resuming Schools and Resuming Classes under Normalization of Pandemic Prevention and Control*" (Ministry of Education of the People's Republic of China, 2020b). Therefore, in the form of government documents, schools must incorporate teachers' and students' mental health into one of the critical tasks of school education after the beginning of school to realize the orderly development of psychological counseling for teachers and students resumption of classes. In particular, pay attention to eight types of high-risk students affected by the pandemic, including students from key epidemic areas, family members or students who have suffered from COVID-19, children of front-line workers in the fight against the epidemic, students in graduating classes, and notable families (such as divorced families, single-parent families, low-income families, families with low parental relationships, etc.), students with poor parent-child relationships, etc., focus on and understand the current learning situation, emotional fluctuations and parent-child relationships of students (Chen & Wan, 2020).

In the United States, the Metropolitan Educational Research Consortium (MERC) of the VCU School of Education reviewed the mental health support measures for students returning to campus during COVID-19 and provided links to educators' related resources in the report. This answers how to solve students and school staff's mental health needs after returning to campus in the current education (Naff et al., 2020).

It can be expected that paying attention to teachers and students' mental health will become a problem that education needs to face for a long time. These psychological problems and behaviors that may occur are caused by the pandemic's psychological

impact on people and action constraints, and the source of stress is evident. Even with the improvement of the pandemic, students will show changeable characteristics as the environment changes. For example, after returning to school, some children may have social fears and a lack of concentration. It is also worth noting that home-based epidemic prevention may cause family psychological problems and affect student psychology. These psychological problems may affect students' life and study, so they need to be rectified and adjusted urgently.

Pandemic Promotes Innovation in School Management

Focus on Family-School Cooperation

School and family are indispensable subjects in the healthy growth of children. Constructing a harmonious family-school relationship and forming a cooperative education pattern is of great significance to students' development. During the pandemic period, home learning brought education back to the family, the family became a temporary school, and the parents became teaching assistants. Family education played a significant supporting role (Anzani et al., 2020). This is a comprehensive test of family education. It tested the family happiness index, tested the relationship between husband and wife and parent-child, tested the parents' ability to build a family, and made parents reexamine the responsibility of the "front-line teacher" (Deng, 2020).

In China, to meet students' learning and development needs, schools use home-school cooperation to give full play to family education's critical role during the "School is Out, But Class is On" period. In this way, parents are guided to participate in online teaching activities actively and offline academic guidance, effectively promoting students' home learning and realizing their healthy and happy growth (Xia, 2020).

In Italy, parents' role during the school closure has been crucial, especially in primary schools where children have a low level of autonomy and self-control. During the three months of lockdown, home-schooling has fostered a closer relationship between teachers and parents, realizing a fruitful integration between school education and family education (Pellegrini & Maltinti, 2020).

Some scholars have suggested that in the US, to effectively meet students and families' urgent needs when schools reopen, state and regional leaders should consider establishing and expanding community schools. In community schools, students and families participate as partners in the education process and receive extensive coordinated support and services (Maier et al., 2020).

The "three-in-one education" of school, family, and society is a generalization of modern education to students' study and life scenes. In regular education, families and schools are each responsible for students' family education and school education. The school's guidance on family education is relatively simple, focusing mainly on parents' feedback on students' learning. During the pandemic period, because students

study at home, family education and school education are integrated into the family space, and family education and school education are passively integrated.

The strengthening of school education not only weakened family education but also weakened its interaction with school education. In the post-pandemic era, family education's importance will become more prominent, and parents' acceptance of family education concepts and methods will consciously increase. Parents will pay more attention to high-quality parent-child companionship, focus on cultivating children's reading ability, good daily behavior habits, focus on children's participation in housework, and focus on the impact of their own words and deeds and parenting methods on children. Parents will have more understanding, respect, and support for schools and teachers, the ideological barriers of home-school communication will be weakened, and the content of home-school co-education will be more prosperous.

Pandemic Makes the School Management Model More Perfect

The pandemic broke out in a large area within a short period left all schools at a loss regarding how to respond. To cope with this sudden disaster, all schools have stepped up their arrangements and prepared for online teaching. In this process, although there is no evidence-based on school leaders in the pandemic, some practical models have emerged that provide instructions and insights on how school leaders operate. As Alma Harris (2020) pointed out, leaders need to establish and maintain a collaborative culture, which involves using the Internet between people when facing challenges.

The Internet-based school management model continues to innovate and improve. In order to ensure the quality of online teaching and the effectiveness of student learning, some schools have established a "four-in-one" online teaching quality monitoring and guarantee system of "real-time data monitoring-secondary teaching supervision-educational work weekly report-online teaching competition" (Wang, 2020).

For most schools, the experience during the online teaching period has enabled the original management model of each school to be effectively supplemented and improved in the online teaching: modular management has changed from offline to online; administrative leaders have joined each class group, carry out contract management; administrative team members stay in each grade group to assist teachers in their work; establish grade groups, teaching and research groups, and class "education communities" (Lu & Zhou, 2020).

Pay More Attention to Teacher Education

Teacher professional development is a crucial factor in ensuring the smooth progress of education and teaching. In this pandemic, the traditional classroom teaching environment has undergone significant changes, and the related teaching activities, teaching space, the process of teaching implementation, teaching methods, and additional tools

used in teaching are all changing. This also means that the connotation of teachers' teaching ability also needs to be continuously extended and expanded. Online teaching requires the educator to master the relevant platform's basic knowledge and the ability to operate information technology. It is even more necessary for teachers to grasp the difference between online teaching and traditional offline teaching in terms of teaching requirements. Therefore, teachers' information literacy has become the key to the effect of online teaching (Ma et al., 2020).

Before this, the digitalization of education has become a hot topic for all age groups in different disciplines, and digital tools have been widely used in schools, but teachers, schools, and related management departments are not prepared to act as digital leaders and change agents (Papagiannidis et al., 2020; Vial, 2019), which leaves schools and teachers at a loss as to how to respond effectively to this sudden pandemic.

In a survey report of 14,348 elementary and middle school teachers in four provinces across the country on online teaching conditions, teachers paid longer working hours than offline teaching, but the teaching effect was average and became the second big problem (Zheng & Ye, 2020).

In Germany, a 2019 survey suggested that a high proportion of teachers were willing to integrate digital tools in their instruction. However, they expressed the need for more professional development related to technology (Rohleder, 2019). The experience of online teaching during the spring semester could serve – as suggested by Michael Schratz – as "the most effective professional development measure of the century" (Schratz, 2020 cited in Blume, 2020, p. 892).

In response to this phenomenon, schools have launched emergency teacher training. The training content mainly revolves around digital skills such as online teaching platforms and resource selection and how to use these additional tools to promote the teaching ability, of course, efficiency effectively.

A study by Dougiamas and Taylor (2000) showed that teachers will have a more direct and decisive influence on students' views when developing distance teaching, which means teachers will bear greater responsibility when carrying out online teaching. In the digital age, where networking and informationization are the norms during the pandemic period, higher and broader requirements have been placed on teachers' teaching ability and quality. It requires teachers to apply information technology effectively and integrate information methods into online classroom teaching correctly.

Therefore, the development of teachers needs to be guided by more professional continuing education. Other areas of professional development include: making and sharing videos, managing students in online courses; involving students in asynchronous and synchronous discussions; building a sense of community; creating ideas for increasing student online participation; and using hands-on activities online, etc. (Williams et al., 2020).

Pandemic Promotes the Accelerated Development of the Education Information Industry

Education has carried out an unprecedented online practice globally to realize that education is uninterrupted even in the pandemic period. Use the integration of information technology and education to realize "School is Out, But Class is On." This worldwide Internet education action has accelerated the development of the education information industry.

Online Education Users are Showing Explosive Growth

As the first country to implement "School is Out, But Class is On," China has implemented online teaching in schools of all levels and types since February. The 265 million school students across China have generally turned to online courses, and user needs have been fully released. Because of the massive demand for online learning, the state united online education companies by publishing free courses, online and offline linkages, etc. The industry shows explosive growth. According to the 45th "*Statistical Report on China's Internet Development Status*" released by the China Internet Network Information Center (CNNIC) on April 28, as of March 2020, the number of online education users in China reached 423 million, an increase of 2.22 from the end of 2018 Billion, accounting for 46.8% of the total netizens (China Internet Information Center, 2020).

The Recognition of Education Informatization Has Been Improved

For a long time, classroom teaching informatization has been facing insufficient resource allocation and a lack of teachers' usage habits. However, this time pandemic unexpectedly gave teachers, parents, and students rare informatization education training, and the recognition of online education has been significantly improved.

As the main driving force of education informatization, relevant departments also saw the development opportunities brought by China's education informatization industry in this pandemic. At the CPPCC meeting in May 2020, there were more than 20 proposals related to online education, including suggestions for the establishment of a free national public education platform, including the construction of a dedicated education network in the national new infrastructure construction project, and accelerating the construction of "Internet + Basic education" public service system, etc. Therefore, accelerating education informatization and reducing the digital gap has become a critical measure to promote the equitable development and quality improvement of education.

In Germany, the COVID-19 pandemic provides an opportunity for the informatization reform of its national education. Among them, the most important is the advancement of DigitalPakt Schule. This agreement is an important resolution initiated by the German Federal Government to promote elementary and middle education informatization in the past two years. It is also one of the six essential measures implemented by the Federal Ministry of Education to promote informatization for all. However, due to various factors, this resolution has not been implemented for a long time. Therefore, the outbreak of the COVID-19 pandemic undoubtedly helped the implementation of this plan. At the same time that the state's primary and secondary schools announced the suspension of classes in March 2020, the federal government immediately allocated 100 million euros in emergency funds in the name of advancing the DigitalPakt Schule to encourage elementary and middle schools to carry out online teaching to protect students' learning rights and teaching order. Although this is a far cry from the previous budget of 5.5 billion Euros, for most schools, it is like nectar. Simultaneously, the federal-state government has also realized the urgency of establishing a virtual teaching network and has begun to invest many construction funds. For example, the Berlin city government allocated 1 million Euros to create a virtualized E-learning Platform, providing local students with nearly 10,000 learning videos, subject-based course resources, and online video teaching (Chen, 2020).

The online teaching experience during the pandemic has brought an excellent demonstration effect on society and schools. This has also allowed countries to continue to increase their attention and investment in digitization and informatization. The cooperation between enterprises and the government will substantially promote education's informatization, moving from the hardware to the interconnection, intercommunication, and sharing of educational resources on a larger scale.

Perspective

The global outbreak of the COVID-19 pandemic has had a massive impact on the economy, politics, culture, and education of countries worldwide, and education is precisely a complete manifestation of all aspects of the pandemic. The experience during the COVID-19 pandemic has once again proved to the world that even when human life and health are threatened, education is also one of the most critical areas needing urgent attention and solutions.

In the current situation of pandemic normalization, summarizing the pandemic's impact on education can help us re-examine education's actual situation. We can see that education has shown various deficiencies in this pandemic, such as the unfairness of education. This unfairness is not only the unfairness between educational resources and educational technology between poor and rich areas, but also the unfairness of the right to education between men and women within the region. In terms of teaching methods, we have also noticed that schools and society are not adapting to online teaching. These incompatibilities reflect the backwardness of education in technology, such as the poor educational information infrastructure, the lack of digital education

resources, and the substandard digital literacy of teachers and students. Besides, teachers' and students' psychological trauma in this pandemic has also caused us to reflect on whether education should pay attention to the cultivation of spiritual self-repair ability and teaching and educating people (Kohrt et al., 2020)?

At the same time, we are also delighted to see the changes in education in this sudden pandemic. The most significant is the change in teaching methods. Online education has become a mainstream learning method. Even after returning to the classroom, technology and education still show a trend of interactive integration. In a middle school in Sichuan, China, after the pandemic, the use of information technology to open up all the data of online and offline education and learning, accurate records, academic analysis, and a complete knowledge map built on data will further play its role. In this way, the optimization of educational effects has been realized, the enthusiasm of school teachers and students has been further promoted, a positive cycle has been formed, and the in-depth integration of online and offline models has finally been implemented (Li, 2020).

A similar experience took place in Italy after school reopening in September. Numerous secondary schools started to use blended learning with combined in-person and online activities to provide all students with educational content (Ministry of Education of Italy, 2020). Online activities are planned by the class teachers using synchronous and asynchronous modes to ensure adequate education and interactions among students of the same class.

There are more and more schools like this around the world. They are using their high-quality educational resources to maximize their superior resources' radiation, enabling more regions, more schools, and more students to share better educational concepts and educational resources and jointly promote regional education development. This is also the real impact of the pandemic on education, that is, not only survive, but also become more robust.

This teaching method's change and popularity also show us that having digital literacy skills and technology in education is no longer an option but a necessary fact. It can be seen from the cases of different regions and schools that digitalization is becoming a new driving force in all aspects and links of educational development. In the online education actions during the pandemic period, digital-driven education innovations can be seen everywhere, and various integrations beyond disciplines, classrooms, and schools have become the general trend (Dwivedi et al., 2020). To this end, all education-related parts or personnel should learn to adapt and develop their digital literacy.

However, at the same time, in using digital technology to promote education development, we should also have a clear and rational understanding of the limitations of digital technology. Intelligent digital technology will help people learn more accurately and effectively in the field of "computability," but "education is not only about acquiring skills but also about respecting the values of life and human dignity" (UNESCO, 2019). Education in the intelligent digital age cannot fall into the pitfalls of technological; at the same time, it needs to transcend pure utilitarianism and return to the humanistic standpoint of using intelligent technology to promote the healthy, free,

and all-round development of people and help people achieve a better life. Therefore, the educational informatization we pursue is the simple addition of technology and education and the realization of students' growth and development while taking into account the various requirements of school teaching conditions, teacher teaching habits, and the current educational environment. It is responsible for improving teaching quality and promoting educational equity, and promoting social development.

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REVIEW

Review on the Compulsory Education Status of Migrant Workers' Children in Chinese Cities

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***Abstract**: With the advancement of China's economic and social development and urbanization, the scale of out-of-town migrant workers has been expanding. Following this, migrant worker children's education problem has become increasingly prominent and has gradually become a focus of education research. This paper reviews recent studies on migrant worker children's acceptance of compulsory education, and summarizes its existing education problems, aiming to provide direction and support for further promoting education equity and sustainable development of urban and rural education.*

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Question

WITH the rapid development of China's economy and the acceleration of urbanization, there has been an imbalance of urban and rural economic development. As a result, a large number of migrant workers have poured into cities to seek work and development opportunities, forming a huge "farmers' frenzied hunt for work in cities (Min Gong Chao)." According to the "2019 China migrant worker monitoring survey report" released by the National Bureau of Statistics of China (2020), the total number of migrant workers[1] in China in 2019 reached 29.77 million, of which 116.52 million were local migrant workers[2] and 17,425 were out-of-town migrant workers[3]. Among the out-of-town migrant workers, there were 135 million urban migrant workers[4] living in cities and towns at the end of the year.

At present, China's mobile population has developed into a form of "long-term" and "family-based". The study by Wang et al. (2019) showed that since the mid to late 1980s, not only has the number of migrant workers in China increased sharply, but their age structure has also undergone specific changes: after leaving the registered permanent residence, migrant workers in cities initially Young people are mostly single, and now they are gradually developing into family migration. Since a considerable number of the mobile population is leaving the town with their families, their children also leave the registered permanent residence and the original place of education. According to the "*Law of the People's Republic of China on Compulsory Education*," compulsory education is managed by the local government at different levels. Compulsory education for school-age children is mainly handled by the government of their registered permanent residence, and education funds are allocated according to the number of registered permanent residence students. In this case, when children move to cities with their parents, the registered permanent residence government can no longer be responsible for their education, and the local government is not obliged to provide them with education and school. Therefore, when migrant workers' children leave the registered permanent residence, they cannot enjoy the educational resources of the place they migrated.

In addition, affected by factors such as distressed economic conditions, low level of education, unstable work, and high mobility, migrant workers are mostly weak and marginal in integrating with urban life. They cannot guarantee that their children receive complete and high-quality basic education and even higher education, but out of a strong desire to change their living conditions, they have more urgent educational needs (Zhang, 2015).

In this context, the education of migrant workers' children is a problem that will inevitably arise in the process of China's urbanization and the transfer of rural surplus labor, and it is also one of the livelihood focal points that are increasingly being discussed in the society. With the widespread concern of all sectors of society, some domestic scholars have also begun to research the education of migrant children. This research uses the relevant documents included in the China National Knowledge Infrastructure (CNKI) and academic paper databases such as Wanfang Data and the quantitative analysis method software CiteSpace to organize and analyze this research field in recently decades. At the theoretical level, it enriches research on the education of migrant workers' children and provides directions and references for subsequent theoretical research and related policy formulation and implementation.

Research Hotspot Analysis

Unlike the urbanization process of Chinese society, after the second industrial revolution, the population moved freely between countries and regions, and countries did not take mandatory measures to restrict migration. Children of "international migration" personnel who frequently move between countries and regions also enjoy the same educational conditions as children of local personnel. Therefore, there is neither a particular group of "migrant workers" nor research on migrant workers' children's education in research outside of China. Therefore, "migrant workers" can be said to be the only product of Chinese society's urbanization process, so this study mostly uses China's research literature.

By the end of November 2, 2020, a total of 790 articles were retrieved in databases such as CNKI and Wanfang Data using "migrant workers' children" as the keyword. From the keywords' chronological order, we can draw this field's research trend in the past two decades. It is not difficult to find that the research on migrant workers' children began in 1998. Since 2002, the number of publications has risen sharply, reached its peak in 2013, and then gradually leveled off.

Discipline Distribution of Research

From the perspective of discipline distribution, 45.9% of the literature discusses the hot topic of migrant workers' children's compulsory education in conjunction with related education theories. Secondly, 15.8% and 11.04% of the literature analyzed the status quo of migrant workers' children receiving primary education and higher education. Third, there are also a small number of studies that follow the ideas of sociology, psychology, talent science, and labor science. In general, research conducted with education occupies half of all the literature. The education of migrant workers' children of different ages has aroused numerous discussions among experts and scholars.

Research Subject Analysis

At the research level, researchers at the higher education level have become the leading group in this research field, covering 89.1% of all the literature authors, reflecting the high degree of concern for migrant workers' children in academia. Besides, basic education level researchers represented by elementary and middle school teachers have also shown corresponding interest in research around migrant workers' children, accounting for 6.1% of the existing literature. The remaining 4.8% of the researchers are from the General Office of the State Council, which showed that the education of migrant workers' children is closely related to the formulation of specific policies. The realization of educational equity is also inseparable from the State Council's allocation and adjustment of educational resources. Solving the education problem of migrant children should be the result of multiple factors.

Hot Spot Analysis of Research Fields

According to the subject distribution results of the database search, in addition to the keywords "migrant workers" and "migrant children" used in the search, the main themes with the highest frequency are "compulsory education," "Ministry of Education," "children education" and "learning habit." Secondary themes focus on social issues such as "public schools," "education equity," "private schools," and "migrant workers children's schools." As a result, whether migrant workers' children can receive education fairly and equitably, especially in compulsory education, has become a top priority for Chinese scholars (**Table 1**).

This study systematically reviews and summarizes the research results on the education of migrant workers' children from education based on defining related concepts.

Related Concepts

Migrant Workers

Regarding the definition of "migrant workers," so far, there has not been a unified, widely recognized, and acceptable concept in academia and this concept has been continuously enriched and supplemented with the development of the times.

For example, Duan (1998) defined "migrants" and "migrant workers" from the perspective of management. The migrant population refers to those who live or stay in the local area for an extended period or the population in surrounding towns and towns without a local household registration. They do not include those in the "mobile population" who migrate from local to other regions. However, "migrant workers" have a fixed occupation and corresponding income among the migrant population.

Zuo (2014) mentioned that under the dual urban-rural system, the society and economy are making rapid progress, which stimulates the emergence of migrant work

Table 1. Keywords and Frequency.

Keyword	Frequency
Primary Keywords	
Migrant Worker	397
Migrant Children	193
Compulsory Education	109
State Council	54
Children Education	37
Migrant Children Education	30
Learning Habit	29
Entrance Examination	18
Secondary Keywords	
Migrant Worker' Children	73
Public School	47
Migrant Children	36
Education Equity	34
Education Administration	17
Private School	13
School for Children of Migrant Workers	13
Public Elementary and Middle Schools	12

ers. Therefore, in theoretical research, it is generally mixed with migrant farm workers and migrant workers. However, with the development of society, the term "migrant farmer worker" is discriminatory. After 2007, the Chinese government officially changed to "migrant workers" in the document.

Migrant Workers' Children

Similarly, there are many similar titles about "migrant workers' children," such as "migrant farmer worker children," "farmer worker children," "rural worker children," "rural oriented children," "mobile student," "mobile children" and many more.

National and local governments will also explain the characteristics of this group in relevant documents. For example, in 2012, the General Office of the Jiangsu Provincial Government "Notice of the Children of Workers Coming to Jiangsu to Take the Entrance Examination"[5], defined the scope of "migrant workers' children" as: Nanjing migrant workers' children specifically refer to children who are within the stage of compulsory education and follow their migrant parents or legal guardians, school-age children and adolescents who have temporarily come to Nanjing but without a registered permanent residence. It does not include the children of migrant workers whose household registration is in the city.

Based on government documents, scholars have elaborated on the connotation of "migrant workers' children." For example, Zhou (2016) believed that migrant workers are non-local migrant workers, including migrant workers and all kinds of migrant workers in non-registered permanent residence cities.

Wang (2019) believes that the concept of migrant workers' children has two levels of meaning. The first meaning refers to the children of migrant workers born in the city or minor children who follow their guardians to study and live in the city. The second meaning refers to the left-behind children of migrant workers, minors whose guardians work and settle in other places, and their children stay in their registered permanent residence and receive local education.

Based on this, there is no unified expression for the scope of the group of "migrant workers' children," the nature of work, and the age division of the children. However, there is a high consistency in some characteristics, such as migrant children whose parents are not in the city where they work, and their children have not reached maturity.

The Education Status of Migrant Workers' Children

According to the "2019 Migrant Worker Monitoring Survey Report" of the National Bureau of Statistics of China, 50.9% of migrant workers report that migrant children face some problems in urban schooling, especially in the stage of compulsory education, due to the difficulty of local education and high costs, which caused the migration Children's schooling problems (China Statistics Bureau, 2020). Migrant children generally go to three types of schools in migration: public schools, schools for migrant children, and private schools. However, private schools charge high fees and often reject many children from low- and middle-level migrant workers' families. Therefore, most migrant children enroll in schools for migrant children or enter urban public schools by paying the borrowing fee (Xie & Xiang, 2019).

Research on the Acceptance of Migrant Workers' Children in Public Schools

After migrant workers and their children enter the city, they cannot enjoy various national treatments (such as education rights, labor security rights, etc.) because their household registration is still in their original residence. If the children of migrant workers still have to receive compulsory education in the place of migration, they have to use some unconventional means, such as paying borrowing fees and sponsorship fees. The direct consequence of the fees is that some students are out of school due to limited family financial affordability or deterioration of family economic conditions (Mak & Zheng, 2018). Therefore, in the early research, a large number of empirical research investigations showed that migrant workers' children have difficulties in entering public schools in the places where they moved (Lv, 2012; Chen & Wang, 2016), and even abnormally school-age severe children drop out of school (Chen, 2007; He & Li, 2007).

After investigating the enrollment of public elementary schools in Hangzhou, Wang (2019) stated that the scarcity of high-quality educational resources had made migrant workers' children's educational opportunities, who are already deficient in family resources, more unequal. Public schools sometimes cannot even guarantee the attendance of local children. Out of helplessness or for better educational opportunities, children of local residents choose private schools to complete compulsory education. However, the high tuition and accommodation fees of high-quality private schools require tens of thousands to hundreds of thousands a year, which discourages the children of migrant workers.

Research on the Acceptance of Children in Schools for Migrant Workers

The school for children of migrant workers first appeared in China in the 1980s. It is the product of the era when the society has developed to a certain period in order to alleviate the scarcity of educational resources and protect the right to education of school-age children. Schools for children of migrant workers are mostly located in urban-rural fringe areas, mobile population gathering areas, and low-rent areas. In the early days, due to the lack of sufficient funds, the school buildings of these schools were mostly rebuilt or built, without sufficient lighting and crowded classrooms, and the schools lacked necessary teaching and sports equipment (Yang & Tao, 2007); the source of teachers was complicated, and most of them did not have teaching experience, and teaching quality is generally not acceptable (Wang, 2012); and some schools still have hidden dangers in food safety, traffic safety and fire protection (Lou, 2009)

Even though the teaching environment is rudimentary and the teaching quality is low, private migrant worker schools have low entry barriers, low tuition, and flexible charging methods. Therefore, every year, many migrant children are enrolled in these schools. It can be said that private schools for children of migrant workers undertake some essential tasks of compulsory education for migrant children (Ma & Sun, 2007). This phenomenon has gradually attracted social attention. Scholars call it the "self-help" grassroots organization of migrant worker children's compulsory education (Han, 2001).

However, with the expansion of demand, a market-oriented "profit-seeking" phenomenon has appeared in the field of migrant workers' children's compulsory education. This is a manifestation of the alienation of compulsory education, utterly contrary to the basic concept of compulsory education. Subsequently, the Chinese government successively issued relevant documents to regulate private schools for children of migrant workers.

The "Measures for Schooling of School-age Children and Adolescents in Urban Mobile Population (Trial)" promulgated in 1996 stipulates that migrant children should mainly study in full-time elementary and middle schools, and those who enter without conditions can receive non-formal education. By 2019, the "Ministry of Education's 2019 Work Points" proposed to improve the enrollment policy of migrant chil-

dren compulsory education based on residence permits. For existing schools for children of migrant workers, relevant departments must gradually incorporate them into legal and regular channels on the basis of ensuring that public schools accept migrant children safely and securely and provide certain financial subsidies and assistance according to the actual situation. Thereby ensuring the quality of education and teaching in schools for children of migrant workers (Wang, 2018).

It can be seen that the Chinese government gradually pays attention to the education of migrant children and strives to protect the enrollment and advancement rights of migrant worker children. On the one hand, China proposes a "two-oriented" policy: "focusing on management in the place of migration, focusing on public schools," and gradually let the children of migrant workers receive compulsory education for free in the place of migration. On the other hand, migrant workers and children are accepted through multiple channels and methods of running schools. As of the end of 2019, 78.9% of China migrant children are studying in public schools; 3.849 million migrant workers are studying in middle schools (Ministry of Education of the People's Republic of China, 2020). Therefore, the pattern of mainly receiving migrant children from public schools has taken shape, and education's starting point improves (Lu, 2016).

Research on the Problems Existing in the Education of Migrant Workers' Children

Migrant workers have a strong need for their children to receive public education and quality education. However, the lack of total education supply and the structural contradiction between supply and demand have caused many migrant worker children to receive education in migration cities.

Research on the Educational Resources of Migrant Workers' Children

Unequal Access to School

Pan (2017) proposed that due to the bias of the dual household registration system, this system takes stability and order as the first element in its value demands, and artificially divides society into two unequal classes in terms of rights and obligations, and invisibly deprived the children of migrant workers of equal rights to compulsory education. Wang (2012) believed that the children of migrant workers who go to school in the city face various entry thresholds, such as temporary registration certificates, household registration certificates, real estate certificates, tax payment certificates, social security certificates, family planning certificates, etc. In the context of "certification to work," the children of migrant workers who want to obtain sufficient educational resources can only continuously meet the various conditions set by the local government.

Xu (2019) analyzed that because the children of migrant workers mostly live in the fringe areas of urban and rural areas, such areas lack public education resources. In order to meet the needs of nearby schools, some children of migrant workers were sent by their parents to private migrant worker children's schools to study. However, most private schools for children of migrant workers simply cannot meet the requirements of private schools' approval standards and are in a situation of illegally running schools. These schools are often very simple and mobile. Not only the quality of education is worrying, but it also brings difficulties to the unified supervision of local education departments. Therefore, it is not easy to ensure that the vast majority of migrant worker children have the opportunity to receive an education.

High-Quality Teaching Resources Cannot be Guaranteed

Because migrant workers live in relatively concentrated areas, and most of them live in the fringe of urban and suburban areas, the contradiction between a large number of students and a shortage of educational resources is unprecedented, which makes the phenomenon of a regional shortage of educational resources very prominent (Li, 2011). Besides, the starting point of these children's education is lower than that of students in the place of migration, and the learning status of migrant children is far from that of local students.

Tian et al. (2008) showed that teachers' sources in private migrant worker children's schools are complicated, especially those who have not been approved for private migrant worker children's schools. 47.7% of teachers were engaged in the business and service industries before they started teaching. This also reflects the current situation of weak teachers in private migrant worker schools.

Xu (2012) also mentioned significant differences between migrant worker schools and public schools in all aspects, whether it is necessary teaching facilities or teachers, the gap is pronounced, and the quality of teaching is difficult to guarantee.

Poor Education Results

In the case of insufficient educational resources, the education results of migrant children are also worrying. Zhou & Hu (2011) mentioned in the study that the Ningbo Municipal Education Authority conducted a sample inspection of the teaching quality of 6 migrant worker schools in the city, and found that the average score of students in public schools in Ningbo was 80, and the pass rate was 85%, while the average score of migrant worker children's schools was 69, and the pass rate was only 71%.

Wang & Xu (2020) conducted a survey using a student questionnaire, parent questionnaire, and interview outline. During 2017, a field survey was conducted with 3,677 fifth- to eighth-grade students from 20 schools in four mobile population cluster cities of Hangzhou, Zhongshan, Guiyang, and Wuhan in China. The survey results showed that under China's territorial education management system, the government of

the place of migration restricts the upward mobility of migrant children through an unequal distribution system of educational opportunities, and the migrant children ultimately directly report back in the form of academic failure. In this study, Wang also conducted a follow-up survey on the migrant children of Wuhan DC Middle School, where they graduated from junior high school. The results showed that among the 68 students in the two classes, 15.9% did not continue to study, 68.2% were in secondary vocational schools, and 6.8% went back to their hometown to attend high school, 9.1% stayed at the place where they migrated to attend high school.

Issues Concerning the Education Management of Migrant Workers' Children

Difficulties in Student Status Management Caused by Frequent Mobility

Zhang (2013) pointed out that migrant workers' children are highly mobile and difficult to manage student status. Even the parents of some halfway transfer students did not communicate with the school at all. The students were still in class the day before but would not come to class the next day. There are also some migrant children, who entered public schools because of some irregular procedures, but they just borrowed in public schools and did not have a school status; some schools used the method of establishing temporary school status for migrant children to manage them dynamically, but they had not achieved the desired effect. On the contrary, the workload of teachers was increased. Also, in schools for children of migrant workers who were not qualified to run a school, some students had no school status, and some students had their school status in the registered permanent residence school. The current school had only established a registration form for the basic situation of the student. The management of migrant children's school status makes the relevant departments very troubled.

Teaching Management Difficulties

Li (2020) mentioned that school-age children in local cities have an educational advantage and belong to an advantageous learning group. The mainstream culture recognized by migrant workers' children deviates from the city's inherent values, and they belong to a foreign group. In addition, migrant children are limited by their living environment and living conditions. They have few new things, and their knowledge is relatively narrow; the backward education level limits some in rural areas, and their life experience and tendencies will conflict with the content of urbanization courses. The inability of rural students to integrate leads to the inability to carry out pre-class preparation activities and after-class extension activities or complete poor results. It is diffi-

cult for these students to participate in classroom activities, so teacher teaching management is complicated (Wu, 2020).

Besides, migrant workers' children lack good learning and behavioral habits and generally have the characteristics of irregular behavior and freedom, such as non-obedience to classroom discipline and major tardy problems. At the same time, their ideological level is low; moral quality is not high, they have undeniable adverse moral transfer problems and "marginal personality" problems; mood swings are volatile, and their thinking is more sensitive, which also affects the regular order of teaching management (Jin, 2019).

Research on the Education Integration of Migrant Workers' Children

Integration is a mutual and two-way process, and integration and alienation are relative terms. It is a social relationship network established by each individual with family, friends, classmates, and other groups. Individuals have corresponding relationships and integration through these relationships and networks (Wang, 2018).

Wang (2013) believes that the integration process of migrant children in the city is not smooth. There are also various contradictions in school integration, mainly manifested as conflicts between classmates, discreet teacher-student relationships; weak learning ability; and low future development.

When migrant workers' children transfer from rural to urban areas, their living and learning environments are very different from before, of which will bring spiritual shocks to these children. In the face of new teachers and classmates, new learning environment, and learning content, they are also a psychological gap between students in other cities because of their clothes, school supplies, and other conditions, causing their low self-esteem. Besides, frequent mobility can make children feel insecure and belonging (Li & He, 2015).

In addition, compared with urban students, the learning ability of migrant workers' children is inherently in a relatively weak position. They have not developed good study habits since the elementary school level. The lack of learning methods and operational guidance, and timely intervention by parents or teachers, often makes them lose clear learning goals and constructive learning motivation, which makes it easier for migrant workers' children to develop inferiority and self-control low ability, weak willpower, strong guard mentality, and other destructive phenomena. It is challenging to integrate into the class group's study life, which intensifies the migrant workers' children's learning-weariness (Wang, 2019).

Research on Family Education of Migrant Workers' Children

Migrant workers' children live with their parents in the city, and their parents have to assume family education responsibility. Family education plays a vital role in cultivating students' awareness of norms and correct study habits. In practice, family education and school education are often incompatible and even lag behind school education.

Wang (2019) pointed out that although nearly 60% of migrant workers adopt democratic education methods for their children, nearly 40% of parents who approve of authoritarian education still use extreme education methods such as beating, scolding, and corporal punishment, which undoubtedly grows Insecurities and worries of the child. Also, because migrant workers are generally eager to become talented, there are often phenomena such as "emphasizing intelligence and neglecting morality" and "emphasizing scores and neglecting ability" in their children's education. When communicating with children, the topic is single, and leisure life projects such as outdoor play, reading, and newspaper reading for children to expand their horizons are rarely arranged. They only focus on academic performance and neglect the cultivation of children's comprehensive literacy. Even if some parents agree on the importance of cultivating children's mental health and thinking ability in their ideology, they have little strength in a specific implementation, and it is not easy to follow through (Lv, 2012).

At the same time, Lu (2016) found that 70% of the parents of migrant children believe that they have a close relationship with their children and talk about everything, but only 13% of migrant children will tell their parents what they are saying. It can be seen that the relationship between migrant workers and their children is not as seamless as they perceive. Such a parent-child relationship will inevitably affect the implementation results of family education. Many migrant workers have no time to take care of their children's education because of their busy lives, and their investment in children's education is insufficient (Pan, 2020).

Limitations and Thinking of Existing Research

This article focuses on the research results of migrant worker children's education issues and analyzes and perspectives the status and problems of migrant worker children's education from different perspectives. It is hoped that it can provide a basis for all sectors of society to gain insight into the children of migrants' schooling situation and provide a reference for governments at all levels to formulate and adjust relevant regulations. Of course, we also see that there are still deficiencies in current research, and the discussion of these deficiencies is to provide directions for our future research.

First, the research theme still needs to be deepened. Most of the existing studies have explored the difficulties of migrant workers' children receiving compulsory education and the low quality of education. However, there is less discussion about their follow-up education and development channels.

Second, the research content has yet to be enriched. The academic research on migrant worker children's education equity mostly focuses on the macro level and rarely involves specific learning and educational activities. For example, are the children of migrants and urban students having equal opportunities for academic success? Do

teachers give equal treatment to students with different family backgrounds, learning abilities, and education levels in teaching activities?

Third, research perspectives need to be more diversified. Most of the existing research is carried out from education, focusing on investigating facts and analysis of phenomena. The education of migrant workers' children is related to the vital interests of migrant workers and their children and the coordinated development of urban and rural areas, and social stability. Therefore, it is not enough to just float on the surface. It is currently necessary to carry out multidisciplinary analysis and turn to theoretical research to reveal the essence of the problem (Cai, 2004).

Fourth, research methods need to be more scientific and rigorous. Judging from the existing research, the research methods are mostly based on descriptive analysis such as questionnaire survey and interview methods, and lack of rigorous scientific empirical research. The only empirical research literature does not exclude factors such as one's grade and age that may cause differences in psychology, physiology, and learning, so it is difficult to get convincing conclusions.

Fifth, the research sample size is not representative. However, some studies use sampling survey methods to analyze samples of migrant worker children in a particular school or a specific district. However, the conclusion still appears weak to decision-makers. Some studies have also extended the overall coverage to multiple counties and villages in multiple provinces and cities. Although the generality of the research conclusions has been dramatically improved, some documents do not explain the specific details of sampling and the detailed results of sampling surveys. Therefore, it is difficult for us to judge whether the results can infer the totality (Lu & Chi, 2008).

From the perspective of social mobility, scientific and orderly mobility is an integral part of society. Social mobility directly promotes economic development and social evolution (Yue & Yin, 2020). These weaknesses of migrant workers have, to some extent, caused unfairness in the education of their children. The children of migrant workers maintain their parents' identity and status and are disadvantaged in the overall social interest structure. Paying attention to this substantial disadvantaged group's education problems is of great significance to promoting educational equity and social development. To this end, the Chinese government is also making continuous efforts to satisfy the fundamental education rights of migrant children through policy inclination or reform. This is not only an unshirkable responsibility of the government, but also a vital driving force for promoting educational equity and social development. This paper only studies substantial compulsory group's education problems of migrant workers' children and produced more research results on the causes and countermeasures of the problems. In future research, on the basis of fundamental research, we will use a multidisciplinary perspective and a combination of multiple methods to make this research increasingly significant and practical.

Notes

1. *Migrant Workers: refers to those still in rural areas with their household registration and work locally in non-agricultural industries or work for six months or more during the year.*
2. *Local migrant workers: refer to migrant workers who work within the township area where their household registration is located.*
3. *Out-of-Town migrant workers: refers to migrant workers who work outside the township area where their household registration is located.*
4. *Urban migrant workers: refers to migrant workers who live in urban areas at the end of the year.*
5. *The People's Government of Jiangsu Province. Notice of the Children of Workers Coming to Jiangsu to Take the Entrance Examination [EB/OL]. http://www.gov.cn/zwgk/2013-01/21/content_2316803.htm, 2020-2-18.*

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ORIGINAL ARTICLE

Operation Mechanism and Evaluation of "County High School Education Model" in the Context of Chinese College Entrance Examination System

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***Abstract**: The "county high school phenomenon" of Chinese rural high school education to pursue higher education has attracted much attention from the education field and society. Earlier studies were mostly from the perspective of education and believed that the "county high school education model" was contrary to education's essence because it emphasized test-oriented education and restrained students' nature and should be discarded. However, this model is surprisingly persuasive for rural families, and it is also a reflection of the rural students' desire to achieve upward mobility through education. This paper analyzed the county high school education model's connotation, expounded its operating mechanism, and systematically demonstrated and analyzed the "county high school education model" from multiple angles. It aims to find a way out for the future development of the "county high school education model" to promote education equity between urban and rural areas and the harmonious development of high school education ecology.*

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Introduction

DUE to contemporary Chinese society's relative stability, social structure changes, and social mobility caused by system changes have decreased significantly, and relative social mobility has also slowed down. Among them, education and further studies have long been regarded by farmers as an essential way for their children to achieve upward mobility. Therefore, the county high school, which has concentrated the best educational resources in rural areas, has become a bridge for rural children to realize their class change dreams. However, under the background of extremely uneven economic development in Chinese urban and rural areas, at this stage, China's insufficient investment in rural education and relatively backward conditions for running schools have severely restricted the development of rural education effectiveness (Liu, 2009). In this context, the "county high school education model" with the primary goal of pursuing college entrance examination and closed management as the main feature came into being. In the past few years, the county high school education model has achieved brilliant teaching results, and the county high school has gradually become synonymous with "great school for the college entrance examination." Simultaneously, due to its suppression of human nature, neglect of students' physical and mental health, and comprehensive quality training, this education model has aroused heated discussions in society.

The first hot discussion on this phenomenon came from a report in 2004 entitled "*Questioning the Pain of College Entrance Examination in Nanjing*." According to the report, as the capital of Jiangsu Province, it has concentrated the highest quality educational resources in Jiangsu Province. However, it has lost its reputation in the competition with other cities, counties, and cities in the college entrance examination. With the increase in the number of college entrance examinations, the number of undergraduate students in Nanjing in 2004 was only 4,700, and the number of admissions was 600 less than the previous year, ranking the last first in the province (Yu, 2004). When public opinion criticized Nanjing education, many parents cited the county-level high schools in northern and central Jiangsu with outstanding college entrance examinations. They advocated that Nanjing's famous schools were not as good as some county high schools in college entrance examination performance (Wu, 2004). Therefore, the "county high school education model," which was initially only famous in some regions, has gradually favored society. In the education field, attention and discussion about the "county high school education model" are raging, and the trend of extracurricular supplementary lessons in high schools is also becoming increasingly popular. Although

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Nanjing urban high school education has successfully reversed this situation after years of hard work, the discussion triggered by the county high school education model is still going on.

The current view is partly based on education and urban perspectives. It is believed that the county high school education model ignores the cultivation of students' physical and mental health and comprehensive quality and should be discarded. From the perspective of social structure, it is found that the county high school education model responds to the government's demand for educational performance and rural families' desire to move upward through education. Bearing the people's ardent expectations in the county, we must go deep into the actual analysis. "County high school education model" is undoubtedly a mirror for us to see and understand contemporary education. A comprehensive review and serious consideration of the county high school education model will help us reflect on the current education system. Find the balance between ideal and reality under the current college entrance examination system. This paper will comprehensively analyze and comment on the connotation, influence, and evaluation of the county high school education model and seek an improvement direction that is more adaptable to student development law under the advanced education system.

The Concept and Characteristics of "County High School Education Model"

The county high school education model is widespread in county high schools, among which key county high schools are the most typical. It is mainly implemented in county-level high schools. It uses a lot of time investment as the appearance, prompting teachers and students to use their best in a closed space; through research and response to college entrance examination, the only goal is to obtain adequate college entrance examination (Li, 2008).

There are different explanations around the characteristics of county high school's educational connotations. Wang (2013) believes that shaping the "county high school education model" includes the following institutional features: using high schools with high enrollment rates as a template to reorganize resources; centering on college entrance examinations for teacher training, and motivating teachers and students based on test results; Class competition and closed management are based on the high score of the exam. Fu (2005) stated that the county high school education model's character is mainly reflected in the closed management of space, which maximizes students' time, keeps students in a state of high tension competition, and makes the college entrance examination score the only measure. Therefore, the county high school education model's composition is inseparable from closed management, a large amount of time investment, professional teaching staff, and "all teaching activities and the starting point

of the current system are the major prerequisites for effectively improving students' enrollment rate."

Based on the previous research, we summarize the connotation of the "county high school model" as follows:

Based on Time Supervision and Habit Training

Cultivating students' study habits, behavioral norms, and time concept is the basis for county high schools to mobilize students. In many high schools that implement this model, the number of time teachers and students invests in teaching activities is the most intuitive indication. Teachers and students often start to get up at around five in the morning and leave the classroom at around ten in the evening. They continue to work and study for fifteen or six hours a day. To ensure such sufficient time, it is necessary to implement closed militarized management to receive training in examination skills without any interference. Under the "county high school model," students cannot walk out of the school without permission. Only in this management mode that is almost isolated from the outside world can students have sufficient learning time and a focused learning attitude (Xu, 2013).

To Motivate Students to Learn As the Core

Stimulating and cultivating a sense of competition is an essential content of school life, and it is also a part of the cultivation of student subjectivity. Under the "county high school model," teachers mainly use examinations and moral education to stimulate students' competitive motivation and improve students' learning enthusiasm. Students are divided into several districts and branches in many county high schools, and student activities are quantified. They rank school districts according to the quantitative results of students and even rank seats in the class. In this way, the students are always in a competitive atmosphere of catching up with each other and spontaneously maintain a strong fighting spirit not to lag.

In addition to examinations, the school will also use moral education to stimulate students' motivation for struggle, allowing students to internalize the spirit of struggle. Specifically, the cultivation of this kind of spiritual power is integrated into the students' running exercises and daily teaching activities. For example, in the running exercises, they shouted out the inspirational slogans "Dare to fight, brave to fight," "Pursue excellence, always strive for the first," etc., using positive psychology to eliminate helplessness and anxiety (Ye, 2015).

Guaranteed by the United Efforts of Teachers

The excellent performance of the county high school is inseparable from the hard work of the teacher team. They are diligent in research and have a strong sense of cooperation.

They can refine each test site of the college entrance examination into specific explanations and training and advance them layer by layer from the shallower to the deeper. Just as the regional model of the "county high school model," the director of the Nantong City Education Bureau in Jiangsu said, "Teachers largely make the college entrance examination results in Nantong." Regardless of the subject, the teacher often corrects the test paper overnight after the test and counts the blind spots of the whole class for targeted enhancement. Teachers at county high schools always take students as graduate students, and it is natural for the college entrance examination to get good results.

Aim to Achieve Excellent Results in College Entrance Examination

Under the "county high school model," the school improves college entrance examination scores and college entrance examination acceptance rate as the leading educational goals, and teaching arrangements and student management around this goal. Through quantitative results, all evaluations, promotions, and bonuses in the school are based on test results. In terms of curriculum settings, content that has nothing to do with college entrance examination have significantly been reduced, and many schools have even begun to divide subjects from the first year of high school and have entered a state of intense preparation for the countdown of college entrance examination in advance.

The "county high school education model" is a self-rescue for schools with weak educational resources under the current college entrance examination system. It takes teachers and students more time and energy as a representation, based on strict learning time and habit management, fully mobilizes teachers and students and stimulates the motivation of both work and learning in competition and collaboration. These high schools use this to improve teaching efficiency and quality and strive to obtain higher education opportunities.

Operating Mechanism of "County High School Education Model"

Based on clarifying the characteristics and connotation of the "county high school education model," we tried to summarize its operating mechanism.

Reorganize Resources Based on Performance

For a long time, the effect of stratified teaching has been demonstrated by many scholars from different perspectives (Shi et al., 2020). Under the "county high school education model," it is an important measure to divide the key and regular classes to develop hierarchical teaching. Among them, the fundamental class is the concentration of high-

quality educational resources within the school. By establishing critical classes, the school combines excellent teachers with high-quality students, laying a foundation for achieving a higher enrollment rate.

Conduct Teacher Training Centered on College Entrance Examination

Teacher training is centered on supervising and guiding teaching activities to ensure that the teacher's teaching in the classroom can be carried out closely around the college entrance examination. Every year, newly recruited teachers undergo pre-job training before they take over their posts. The school selects room-teachers and class teachers with excellent work performance to impart experience to the new teachers and give play to the old teachers' guiding role to quickly adjust and position their roles and adapt to high school teachers' jobs. Eventually, a teaching classroom with direct access to the college entrance examination was quickly constructed.

Under the "county high school education model," the school rapidly improves teachers' professional level through school-based training, advanced overseas studies, expert lectures, teacher competitions and exchanges, and establishment of standards and reviews. Also, a famous teacher selection system must be implemented to select "chief teachers," "backbone teachers," and "teaching experts." These ensure that teachers are qualified to guide students to win in the college entrance examination (Wang, 2013).

Motivate teachers and Students Based on Test Results

The school rewards teachers for their outstanding work performance and students' outstanding achievements. For senior high school students, the powerful spurring force comes from the institutionalization of daily examinations called the college entrance examination training for each class, day, week, and month. Look for the omission of knowledge and strengthen the ability to adapt to the exam. After the exam, weekly or monthly lists will be published to commend those who have performed well to urge and motivate other students. For example, the monthly star's selection is to publish a list of top students' photos in the third year's monthly unified examination. At the same time, this kind of incentive also exists between classes, and the test results can quickly create an atmosphere of class competition.

The most typical reward for teachers is the annual high school teaching performance award. The awards' specific rules are closely integrated with the number of college entrance examinations and the number of people admitted to prestigious universities.

Closed Time Management

Under the "county high school education model," students and teachers' schedule is almost harsh. According to a school that implements the "county high school model," the school teachers must implement a class system. From Monday to Sunday, only one night on Sunday can be absent from work. For the rest of the evening, even if there is no arrangement for lectures or self-study tutoring, teachers must go to school on duty. Therefore, on average, teachers work about 10 hours a day.

For students, the schedule is stricter. Many schools have schedules for getting up at 5:50 in the morning and turning off the lights at 10:30 in the evening. Excluding the 7 hours of nighttime sleep, 2 hours of lunch break, and 3 hours of break time, students have about 10 hours per day for study. For students in the third grade, they tend to take up more rest time for study. Besides, students applying for leave must go through a multi-level process. After the students write out the written request for leave, they must first be signed by the room-teacher, then signed by the grade director, and finally handed over to the school's security department for their release. There are stubs of the leave from in the grade department, class teacher, and security department.

The reorganization of school space resources, teacher training, teacher-student incentives, class competition, and time management together constitute the operating mechanism of the "county high school education model." Through this mechanism, teachers and students of county high school in response to college entrance examination have shaped their unique teaching methods and constantly solidified them into a model.

Evaluation of "County High School Education Model"

Regarding the influence of the "county high school education model," discussions have never stopped. The main reason for this heated discussion is that the influence of the "county high school education model" has its pros and cons.

Evaluation from the Perspective of Education Equity

Educational equity has always been a critical topic of widespread concern. Educational equity in the county is an integral part of the entire educational equity and the cornerstone of maintaining social stability. With the advancement of urbanization, educational resources are inevitably concentrated in big cities, and education in rural areas is becoming more and more declining. In response to this phenomenon, in China's "*Government Work Report*" in 2020, it is proposed to "strengthen the construction of township boarding schools and county schools" and "let educational resources benefit all families and children" (Li, 2020).

Under China's dual economic system, the gap between urban and rural areas is relatively apparent, reflected in the inequality of educational resources and educational opportunities. In a sense, the college entrance examination is a competition between urban and rural education. In the context of the uneven distribution of educational resources between regions and between urban and rural areas, key county high schools

represented by county high schools have become "super high schools" built by many counties with the power of the whole county. Such schools concentrate on the county's highest quality students and educational resources and carry the county's educational expectations. Under the county high school model, the school assumes the primary responsibility for education and implements refined management. They guide students' learning and stimulate their motivation to learn. The improvement of student performance is mainly related to the personal effort of the student during school. Educational competition is manifested in the competition between individual students. In this way, the role of family resources in students' academic performance is weakened, social equity is promoted, and the family's educational burden is also reduced.

Evaluation from the Perspective of Social Mobility

Will there be class consolidation in Chinese society? This is a problem that many people have paid more attention to in recent years. Among the factors that promote social class mobility, individual, family, and social factors all have an essential impact on individual social class mobility; among them, education level has a more profound impact on personal development (Blanden & Macmillan, 2014). Le & Yin (2020) analyzed China's comprehensive social survey data and found that since the reform and opening up, education has kept China at a relatively high intergenerational mobility level in an absolute sense. However, urban and rural education's gradual differentiation has slowed down the relative mobility between social levels.

The county high school model is a management model formed in response to the current college entrance examination system for schools in areas with insufficient educational resources. The current college entrance examination is based on scores. The score is positively correlated with the test taker's effort. This is consistent with the rural families' hope that their children will realize class mobility through education, and it is consistent with the actual lack of family education, economic, and social capital. At present, most of the various criticisms of the "county high school education model" are based on the urban context and the objective position of quality education. This top-down perspective often ignores the "silent majority," that is, rural school principals, rural students, and parents' opinions. Most rural parents undoubtedly support the "county high school education model," which is based on considering the function of education to promote social mobility.

The county high school adjusts its management model to improve the quality of education and increase enrollment rate under the external pressure from rural families and social expectations, the pressure from the government's assessment, and the internal pressure of its development. Fully mobilize teachers and students, stimulate teachers' teaching subjectivity and initiative, stimulate students' learning subjectivity and motivation, provide policy support to students from disadvantaged families, and improve teaching efficiency and quality of education.

Evaluation from the Perspective of Education Reform

At first glance, the "county high school education model" is inspired by the fierce competition for further studies in the Chinese exam-oriented education system. However, from a fundamental point of view, the utilitarianization of education caused by traditional concepts, the employment system based on academic qualifications, and the college entrance examination system for selecting elites for universities is the real underlying reasons (Qian, 2000).

In China, education has always been positively correlated with an individual's income level and professional status. Educational practice has been simplified as a talent training process based on knowledge learning, test scores, and high-quality academic qualifications. The "county high school education model" is one of the concrete manifestations of educational utilitarianism in the high school stage. In advancing education reform, it is difficult to comprehensively evaluate students' quality, which has always been challenging to reform China's college entrance examination. It is also the real source of the "county high school education model." Bailing Hu, the principal of the Central Plains of the Southern Normal University of China and a special-grade physics teacher in Jiangsu Province believed that the reason for the seriousness of exam-oriented education in China today is the education evaluation system that is not compatible with the education policy, especially the unreasonable college enrollment system (Lu, 2005). The national education policy requires the comprehensive development of morality, intelligence, and physical fitness. However, the only criterion for college admissions students is the score of the only entrance examination. Therefore, the basis for evaluating the quality of a school is naturally the enrollment rate.

Professor Xiulan Yu from the Department of Educational Science and Management of Nanjing University also believes that the college entrance examination system gave birth to the county high school education model: "Good universities are always a scarce resource in China, and China's population is huge. The market economy is characterized by competition, and the competition in China is particularly fierce, so schools, students, and parents have no choice but to be in it. For the vast majority of children, if they fail to enter the university, it means a loss of opportunity" (People's Daily Online, 2005). Although some media have proposed that an admission system that combines admissions examinations, graduation examinations, and comprehensive quality assessment can be implemented so that universities can understand how students grow up in high school. However, it is difficult to assess the "comprehensive quality" of a high school student within three years, and it is even more impractical for the university to send someone to each middle school to observe each student in-depth.

Evaluation from the Perspective of Individual Development

Xu (2013) pointed out that the county high school education model exists to pursue a high school enrollment rate. The school deliberately "grasps the best and let go of the poor," neglects to teach students per their aptitude, and lacks supervision, leading to severe unhealthy trends, advocating "totally closed militarized management," weekends and holidays make up classes to improve performance. Long-term implementation of this kind of education will undoubtedly cause severe harm to students and teachers' future.

● *"County High School Education Model" Is Not Conducive to the Individual Development of Students*

Under the county high school education model, the teaching activities closely revolve around the center of "examination," leading to simple and repeated mechanical training. The tendency to focus on details and seek perfection in examinations draws students' attention to the details too much, drives students to be cautious and neglects the mastery of the overall structure of knowledge, and cannot even understand the overall structure of knowledge use knowledge flexibly. This ultimately resulted in narrowing students' interests, reading range, and knowledge (Wang, 2002).

Besides, from the perspective of talent training, the "county high school education model" mostly adopts over-learning and intensive training. This model confines learning within the textbooks' scope so that students have no time to participate in extra-class activities to broaden their horizons and further contribute to their cognitive limitations. This model can easily cause the negative impact of students' high scores and low ability, which is not conducive to students' healthy development in the future.

● *"County High School Education Model" Is Not Conducive to the Professional Growth of Teachers*

With the continuous advancement of education reform, teachers' education and professionalization have been continuously emphasized and strengthened. From Stenhouse's "Teachers Become Researchers" to Elliott's "Teachers Become Action Researchers," and then to Kemmis's "Teachers become emancipatory action researchers, the professional development of teachers has become an important way to promote the growth of teachers and improve the level of education." Under the "county high school education model," the working hours of teachers have been significantly increased, and the health and professional development problems that this brings with" follow (Li, 2010).

With the massive expansion of the "county high school education model," the county high school model has been naturally brought into the principal schools in the eastern or central developed regions. Many outstanding teachers in rural areas have been introduced to urban schools, while the remaining teachers have to take on more

difficult teaching tasks. Under increasing pressure, many teachers leave or change careers, and the brain drain in the education field is getting worse (Zhang, 2017).

Conclusions and Perspectives

Due to the imbalanced distribution of educational resources between urban and rural areas and the differences in urban and rural families' educational capabilities and resource acquisition capabilities, this has resulted in differences in rural and urban students' knowledge and capabilities before entering high school. However, both rural and urban students have to face the competition of unified college entrance examination, which requires county high school teachers whose primary source of students is rural students to devote more time and energy to guide students. Facing the fierce competition of college entrance examination, "all-round development" is a complete luxury for rural students. Therefore, the county high schools, which are weak in the urban-rural structure, cannot tolerate too much romanticism. The county high school, which bears the majority of rural families' trust and expectation, takes the improvement of college entrance examination scores and college entrance examination acceptance rate as the leading educational goals under limited resources, and teaching and student management around this goal is reasonable and makes sense. However, because the county high school education model has also caused severe harm to students' growth, this model's long-term development will undoubtedly harm China's education endlessly.

Therefore, with the competition of college entrance examinations becoming fiercer than ever, the high school learning process cannot be so easy under pressure. The high-intensity learning of county high school students is not the result of the model itself but an inevitable phenomenon under fierce competition. There is also room for improvement in county high school management, making management more efficient and more humane; making education more in line with quality education requirements.

With the continuous advancement of education reform, some schools have tried to combine the "county high school education model" with the "urban high school model" (compared to the lack of rural education resources, it means the abundant educational resources and advanced Teaching methods and concepts). For example, Nanjing No. 9 Middle School and Nanjing No. 13 Middle School, under the "New Urban High School Model," emphasize that schools should have rigorous management, but more importantly, students should be given time for their arrangements. It attaches great importance to students' behavior and habits and fully considers students' needs in the management system (Huang, 2020).

Compared with urban schools, rural schools with limited resources have also begun to look for a new "county high school model." For example, Huaibin High School in Henan Province and Shimen Middle School in Foshan City in Guangdong Province set "people" as the center and explore new paths of "simple education," turning county-level high schools into high-quality schools in the new era (Lin, 2019; Wang, 2020).

We can see that in the continuous exploration and promotion of education reform, China's education reform is developing towards a diversified educational path. Proceeding from their conditions, each school makes full use of local resources to provide children with more educational choices while the college entrance examination is still highly selective and profitable. Exam-oriented education represented by the college entrance examination is no longer the only indicator of school education success. Strengthening educational ideals and balancing the contradictions between ideals and reality are also our expectations for educational reforms and are also a useful direction for us to practice educational reforms..

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REVIEW

Review of the Personalized Learning In China

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***Abstract**: Teaching students per their aptitude and individualized training is the focus of the world's attention, and it is also one of the eight major concepts of Chinese education. Based on the Chinese Social Sciences Citation Index database, this paper systematically analyzed the concept and connotation of personalized learning in China. Meanwhile, it reviewed the progress of its theoretical research and various support technologies including learning analysis technology, personalized recommendation technology, personalized learning path planning, personalized learning system and environment. We further reviewed the characteristics and key points of China's personalized learning theory research from the perspective of theory, practical application and technological development, and then analyzed the development trend of personalized learning in the era of artificial intelligence.*

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Overview

WITH the development of Internet technology and big data, Internet information technology has revolutionized various industries. Countries around the world have tried to use big data education to promote education innovation and reform. Big data technology is driving more remarkable changes in the education field. "Teaching 2030" in the United States pointed out that the teaching ecology will change: advances in cognitive science and technology enable teachers and students to conduct immersive and personalized learning. Teachers will combine discoveries in brain research and cutting-edge technology to improve teaching based on students' learning styles. Customized and personalized learning programs are required; learning will focus on 21st-century skills centered on critical thinking and problem solving, communication skills, cooperation skills, and creativity and innovation skills. Germany, Finland, Canada, Japan, etc., have all put forward new visions and goals for future education. The Central Government of China and the State Council of China has issued "*China Education Modernization 2035*". One of the eight concepts of education proposed is to teach students by their aptitude and individualized training. It has become an unstoppable trend in modern education to promote education application innovation driven by data and realize the organic unity of education scale and individualization.

Use "personalized learning," or "personalized teaching," or "precision teaching" to search on China National Knowledge Infrastructure (CNKI). Select "EI," "Peking University Core," and "Chinese Social Sciences Citation Index (CSSCI)" as the journal source to get 351 records. The annual trend of publication is shown in **Figure 1**.

In addition to the keywords "personalized learning," "personalized teaching," and "precision teaching" used in the search, the most prominent keyword is "big data." Followed by "personalized teaching model," "personalized learning system," "personalized learning resource recommendation," etc. There are also topics related to the environment and disciplines. Excluding subject teaching and research content, as well as news releases, 106 articles of highly relevant CSSCI sources over the past two decades, were selected. Follow-up research was conducted around these 106 documents.

Analysis of the Research Trend

From the time sequence of the occurrence of keywords, this field's research trend can be drawn. The keyword sequence diagram of the past ten years is shown in **Table 1**.

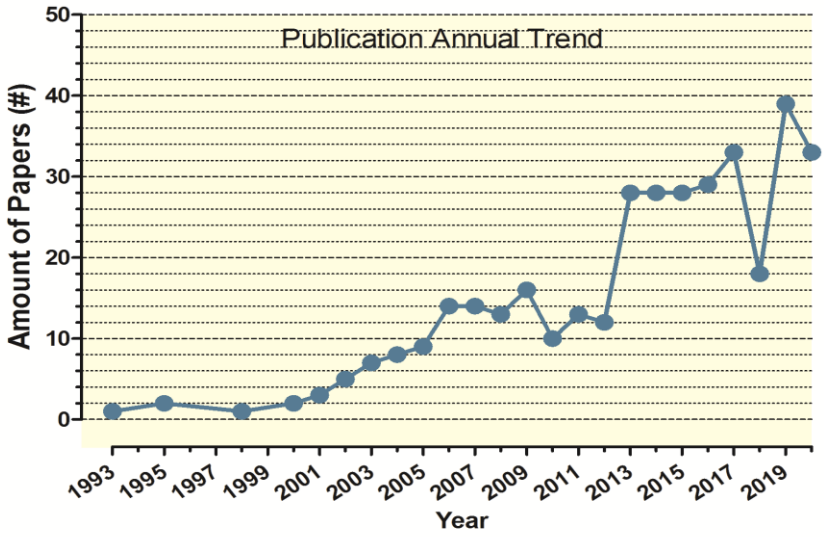

Figure 1. Overall Annual Trend Analysis of the Volume of Related Documents.

Table 1. Keyword Distribution in the Past Ten Years.

Years	Keywords
2011-2012	Personalized Learning, Personalized Teaching, Teaching Mode, Learning Resource Service, Learning Process Service
2013-2014	Personalized Teaching, Precision Teaching, Learning Process Service, Interactive Teaching
2015-2016	Learning Analysis, Electronic Bookbag Learning-Centered, Precision Teaching
2017-2018	Big Data, Learner Model, MOOC, Personalized Learning Platform, Personal Learning Environment, Personalized Learning Path
2019-2020	Personalized Education Artificial Intelligence, E-Learning Smart Learning, Big Data in Education, Online Diagnosis Personalized Learning Path Planning, Rural School

Every two years, it can be seen that the learning analysis was relatively adopted in 2014, and then big data was the most prominent in 2016-2017. Big data and learner models have become research hotspots, followed by personalized learning paths and concepts

related to artificial intelligence technology. In the past two years, education big data and personalized learning path planning are still research hotspots; at the same time, cognitive diagnosis, online diagnosis, development path, and rural education informatization related research appeared.

Personalized learning focuses on the development of students' personality and the improvement of their learning ability. It emphasizes student learning as the center, respecting students' learning needs, learning methods, knowledge background, intelligence, interests, attitudes, values, and other personalized learning characteristics or laws, Exploit the learning potential of each student and promote students' realization' personalized learning goals. In the past, limited by the times, personalized learning only stayed at the level of theoretical exploration. Now the emergence of big data has dramatically changed the way people think and make decisions. Educational big data makes students quantifiable and personalized learning will usher in the era of big data.

Analysis of Current Research Hotspots

By analyzing keywords within five years, the current research hotspots are learning analysis, big data, learner models, personalized learning paths, teaching models, etc. Personalized learning path planning and learning resource push, etc., all belong to the learning analysis category and are based on big data. Teaching mode is a continuous research hotspot, and there are more keywords such as smart education and smart classroom, reflecting the characteristics of the era of artificial intelligence + and the influence of artificial intelligence technology on education.

The follow-up analysis was carried out from the concept and connotation of personalized learning, personalized learning curriculum system, learning process, and technical services. Besides the research results of personalized learning and teaching models, the literature analysis results focused on the current status and progress of the learning analysis techniques based on big data.

Definition and Connotation of Personalized Learning

The learning process of "individualized learning" should be a process in which appropriate methods, means, content, starting points, processes, evaluation methods, etc. are adopted according to the personality characteristics and development potential of students, to promote students to obtain full freedom and harmonious development in all aspects (Li et al., 2005).

Before the advent of the Internet+ era, learners' learning activities were mainly concentrated in the classroom. How does children's classroom learning reflect individualized learning? From the learning process and cognitive process perspective, each child's classroom learning is a personalized process reflected in the student's cognitive process and the relationship between learning emotions and society. Personalized learning is analyzed and evaluated, and five evaluation dimensions are established, including

knowledge and skill goal achievement, individual cognitive process, the cognitive process of group cooperative learning, positive subject emotions, and peer relationship, in order to understand and evaluate the individualization of students Learning provides an analysis framework and series of tools (Xia et al., 2013).

With the development of the Internet and the diversification of learning methods, the observable and recordable learning process makes big educational data a powerful promoter of personalized learning. The digital learning environment enables learners, learning content, learning resources, learning tools, and learning environment has produced a wealth of process data. These data provide a high-value research foundation for personalized learning and teaching and impact the connotation of personalized learning. Personalized learning based on big data learning analysis technology has become education Research trends in science and cognitive science. Big data learning analysis positively impacts stakeholders such as teachers, students, and education administrators in personalized learning. The value of big data in achieving personalized learning is reflected in five aspects: perfecting personalized learner files and analysis predict individualized learning behaviors, optimize individualized educational decisions, improve individualized learning assessments, and provide individualized learning feedback and suggestions (Yang, 2016). Big data has become a new way of thinking and learning path.

The advent of the artificial intelligence era has had a significant impact on personalized learning theory and practice. Artificial intelligence technology with machine learning and deep learning as the core has reshaped and reinvented personalized learning. In the "artificial intelligence+" era, personalized learning should have the theoretical support of "one center, three orientations," centered on learners, and oriented by goals, processes, and evaluations (Mou, 2017). Personalized learning must grasp the learner's mental characteristics first, and then provide content, activities, paths, and evaluations that meet their individual needs for the entire learning process, and finally achieve self-directed meaningful learning on the learning goals. Cultivate the core literacy of independent development on growth goals (Mou, 2017). Personalized learning is a manifestation of the deep integration of technology and education at an advanced stage. With the promotion and assistance of technology, personalized learning has achieved rapid development from organizational form to implementation effectiveness and evaluation methods.

Personalized Learning Curriculum System

The curriculum system of individualized teaching must follow the characteristics of children's development and realize the harmonious and free development of children (Deng, 2000a). It must be complete and adapt to the times' changes and be "ecological" (Yang, 2009). The personalized teaching curriculum system should first include practical experience, metaphysics, and fervent beliefs (Deng, 2000b). Simultaneously, micro-courses are designed for a particular concept or theme, contain the latest cultural knowledge, and reflect the time-courses can meet students' needs for spiritual and prob-

lem courses and maintain dynamic changes in the courses, forming curriculum ecology. To meet students' diverse individual needs, the courses should also have multiple options. Compulsory and multiple optional courses influence and complement each other, embody autonomy and individual thinking, and promote the free development of students' personality.

In recent years, the rise of online learning platforms has made personalized teaching research more online. Under the concept of promoting and supporting learners' personalized learning, The MOOC learner's personalized learning ecosystem consists of four parts: learners' personalized learning, interactive learning environment, technical functions, and evidence-based quality improvement (Yang & Jiao, 2014). MOOC learners' personalized learning is the core part of the MOOC design framework, which provides the basis for designing the other three parts. With the substantial increase in MOOC course construction, MOOC development's value orientation will affect the course subject's value orientation in the MOOC development process. To realize MOOC development's value orientation that promotes personalized learning, it is necessary to start from the education administration department, universities, teacher teams, and MOOC platforms. The operators' joint efforts clarify their critical responsibilities from system supply, MOOC development concept, development process, technical support, etc., to realize personalized learning MOOC (Feng, 2019).

Personalized Learning Process

The Roles of Teachers and Students

The individualized learning process requires the teacher's individualized teaching to meet the students' individualized learning to promote students' overall development. As early as the end of the 20th century, personalized teaching advocated "student freedom theory," emphasizing that students start from their personal needs in the process of personalized learning, are the masters of their learning, and have personalized learning plans according to their wishes. It embodies the idea of "student-oriented."

Learning Mode

Individualized learning and teaching aim to fully consider learners' individual needs and provide more targeted learning resources to obtain a more efficient learning process. How to organize personalized teaching to promote personalized learning, teaching design and implementation strategies to adopt, teachers and researchers continue to explore and research from the theoretical and practical levels and develop some effective learning and teaching models.

Take the Individual as the Starting Point, Goal-Driven

The primary condition for personalized learning is individualized needs. Learners have a clear goal to have strong learning motivation. The goal-driven personalized learning model is based on a computer application system. The learner proposes clear learning goals and is driven by goals. Learners create all kinds of necessary learning conditions and stage goals and promote the advanced process. The system focuses on individualized development and has the characteristics of clear goals, independent choice, transparent process, etc., which is very positive for learners' learning enthusiasm (Zheng et al., 2010).

Make Full Use of Network Platforms and Resources

The development of the Internet makes the use of the Internet to achieve teacher-student, student-student interactions more and more convenient and faster, and the use of the Internet environment to build a personalized learning innovation model can be specifically designed from the aspects of learning path, learning resources, learning support, learning evaluation, etc. The learning path can be divided into goal-based learning, systematic learning, task-based learning, and self-selected learning (Zhong, 2012); students can freely choose according to their learning interests, plans, motivations, and needs, etc., and provide different learning paths. Personalized learning resources; at the same time, provide necessary learning support for students' personalized learning and communication activities, including guidance support and student support, etc.; and through learning evaluation and feedback, help students understand their learning situation and adjust their learning behavior in time. Improve the efficiency of personalized learning.

MOOC learners are mainly engaged in personalized learning in a unique learning situation. If learners want to choose and customize personalized courses and achieve personalized goals, they need to be proactive, immersed in the course content and interactive process, and be creative complete course tasks and reflect. The personalized learning process in the MOOC learner, personalized learning model is divided into five stages: activity/learning path selection, planning/management, conceptual integration of knowledge, and knowledge creation (Yang, 2014). First of all, learners should make their courses according to their private foundation and needs, and secondly, they should make their learning plans by choosing courses. The third is to create a link between the actual knowledge and the new learning; the fourth is to integrate and construct the acquired information to form a new knowledge structure of its own. Finally, through analysis, reflection and evaluation, and abstract sublimation, new knowledge is created (Yang, 2014). From the essential elements of the learning process and supporting MOOC learning conditions, MOOC learners' learning process can be divided into four stages: pre-analysis, MOOC technical functions, interactive learning environment creation, autonomous learning, and learning result evaluation (Yang, 2016). In the preliminary analysis stage, MOOC learners are analyzed in detail from the four aspects of learning purpose, learning experience, learning background, and participating activities. The course platform provides technical support and learning environment services in the learning environment's creation stage; the autonomous learning stage is divided into

five parts: learning resource selection, learning strategy formulation, knowledge conceptualization, knowledge integration, and knowledge innovation.

The development of high-quality online courses gave birth to the flipped classroom teaching model. The flipped classroom puts the traditional knowledge transfer part before the class, and the class focuses on problem-solving, discussion, and collaborative learning, thereby promoting knowledge internalization and ability transfer. Integrate personalized teaching with the flipped classroom model to realize a flipped classroom teaching model based on the concept of personalized learning (Wu, 2015), which consists of three parts: pre-class, mid-class, and post-class (Wu, 2015). Prepare for personalized learning strategies and resources before class, and transfer learning resources and exercises through instant messaging software for corresponding pre-class knowledge transfer. In the class, in a personalized learning environment, a problem-oriented task situation is created, collaborative learning, independent learning, and personalized guidance are carried out, and results are summarized, and personalized evaluation, and finally solve problems and promote knowledge internalization. After class, teachers and students reflect at the same time. This model respects individual differences. In the knowledge transfer stage, students complete it independently before class; in the knowledge internalization stage, teachers guide students to collaborate and complete it independently, which is an efficient mode of personalized learning. However, there are still many challenges in teaching practice, such as the guarantee of the learning effect of knowledge transfer before class, and the time and progress control of the teaching process in class need to be continuously explored in practice.

Diversified Classroom Types

In the field of basic education, the central place of learning is still the classroom. To achieve personalized learning, it is necessary to transform the uniform class teaching mode and present classroom types diversification. Each student is unique, and individualized learning should have various classroom types such as regular classes, lectures, free learning classes, and exhibition exchange classes (Ding, 2013). These classroom models have achieved remarkable results. They organically combine individual teaching, group teaching, and group teaching. They can not only realize independent learning from the needs of students, but also share differences through group cooperation and exchanges, and at the same time give play to the exchange of teachers and students in collaborative teaching (Xiong et al., 2014). Among them, group learning plays an important role as an intermediary between individual learning and collective learning. Group learning can be divided into communication and sharing, division of labor and collaboration, help and support, mutual evaluation, and promotion (Liu, 2014). The type is suitable for different learning scenarios, with different requirements and learning processes.

Personalized Learning Service and Technical Support

Personalized learning aims to take students as the main body and provide personalized resources and services based on students' individual needs to maximize the learning effect. The development of the Internet, the emergence of big educational data, and the popularization of artificial intelligence technology have provided more accurate support services for personalized learning and teaching.

The service and technical support of personalized learning can be summarized in the following three aspects:

Learner Analysis

As the executor of personalized learning, learners are the focus and focus of research. The methods and approaches to acquire learners' learning needs and learning styles become more sophisticated and intelligent with technology development. With the Chinese government's commitment, significant breakthroughs have been made in China's education informatization work. In the past three decades, national informatization construction achievements, especially education informatization construction, have provided a strong technical guarantee for developing this large-scale online education activity (Zhou et al., 2020).

Measurement of Learning Style

Students of different learning styles have different preferences for learning resources, environments, and learning strategies. They significantly impact personalized learning and prompt researchers to design various learning style measurement methods to determine learners' learning styles and match suitable learning strategies and learning resources to provide more targeted learning services. Zhao et al. (2015) designed a learning style measurement and personalized learning strategy online guidance system based on the distance education environment, matching and calculating the learning style and learning strategy, and finding a learning strategy more suitable for learners, which can effectively help distance education under the environment, learners develop personalized learning.

Analysis of Learning Needs

The core part of the analysis of learners is the analysis of learning needs. From the perspective of system dynamics, simulation analysis is carried out on the changes in learners' learning situation and its main factors (Mou et al., 2018). It is concluded that the content difficulty and evaluation criteria are personalities The main factors for the changes in the demand for oriented learning, the difficulty of content is highly positively correlated with the total knowledge of learners, and the demand for learning interest is highly positively correlated with the evaluation criteria. This positive correlation is different in different courses.

Analysis of Learning Behavior

Compared to teacher-centered teaching that emphasizes knowledge transfer, students' autonomous learning pays more attention to cultivating students' inquiry abilities and thinking styles (Zhou & Li, 2020). The research of personalized learning support services also originated in the field of distance education. Analyzing online learning behaviors and providing personalized resource recommendation is the leading research hotspot before the advent of the big data era. As the measurable data of users' offline learning behaviors increases, education big data Learning analysis has been extended from online to offline, and behavior analysis has also been extended from online data to the classroom. It is profoundly digging into learners' daily learning behaviors.

Learner Modeling

Learner modeling uses related modeling theories to analyze characteristic learner elements, collect and analyze many user bases and behavior data, and use computing algorithms and artificial intelligence technology to obtain learner learning characteristic data to form a personalized learning characteristic data set.

The initial research of the learners modeling focused on distance education. The CELTS-11 learner model specification is designated explicitly for learners in China's distance education to meet Chinese education's actual conditions. It described learner information from eight aspects: personal information, academic information, management information, relationship information, safety information, preference information, performance information and work information (DLTSC, 2002), a multi-level and multi-dimensional network education personalized learning model designed based on this model (Sun, 2017), consisting of three levels: data layer, logic analysis layer, and application layer composition (Sun & Zhang, 2017), the data layer contains personal description information (personal information, management information, safety information) and learning-related information (academic information, performance information, work information), as well as related information and preference information. The logical analysis layer based on this data layer includes learning content analysis, learning behavior analysis, and interaction analysis. The logical analysis layer based on this data layer includes learning content analysis, learning behavior analysis, and interaction analysis. Many aspects, including the content and types of learning resources, learning goals, learning completion and participation, resources and media selection, as well as learners' social networks, interactive communication, and visit behavior, are analyzed. Furthermore, combined with personal information, extract learner's attributes, learning style, cognitive ability, and learning attitude, realize the construction of multi-dimensional learner characteristics, to provide a decision-making basis for the application layer.

User Portrait

The development of artificial intelligence and big data technology and its popularization in campuses promoted smart campuses' development and gave birth to education big data. Any improvement in learning forms and mobile terminal software and hardware technologies can enable learners' learning behaviors to be monitored, measured, and stored. The personalized learning process's primary data, such as necessary personal information, elective course information, homework and exam information, attendance records, and even classroom status, can be obtained through various platforms and environments. User portrait is to obtain a tagged user characteristic model by deeply digging into various data information related to the learner (such as basic personal information, learning interest, learning style, resource preference, interaction situation, and interest change). Through an in-depth exploration of learners on various platforms (such as educational administration systems, learning apps, social platforms, etc.) to obtain learners' basic information, learning content, learning progress, learning logs, shared learning materials information, published and participated topics and discussion content And other relevant data. Unstructured data and semi-structured data can be identified and transformed into structured data (Liu, 2019), which can an in-depth and detailed description of the student group from the perspective of individual learning needs. Lay a decision-making foundation for providing personalized learning services.

Learning Support Services Based on Learning Analysis

Personalized Learning Resource Recommendation

With the increasing number of open resources, it is convenient to extract useful resources from many learning resources to promote teaching and learning. To achieve personalized recommendation and distribution of learning resources in a resource-sharing environment is the most needed learning support for distance education learners. The early resource publishing and sharing system (Wang, 2008) can automatically track and record learner needs and evaluation data, form learner characteristic data and use appropriate matching algorithms to calculate the relationship between learner characteristic data and resource description data. The learner recommends the distribution of appropriate resources (Wang, 2008). For the online learning environment's resources, the role case reasoning agent's cooperation framework (Yang, 2009) can use case reasoning technology to solve learning resources' personalized recommendation (Yang et al., 2009). Resources and tools were different forms of learning after processing and were the main environmental conditions for teachers and students to complete knowledge construction. Whether at the teacher's terminal or student's terminal, resources and tools included study cases, e-books, micro-courses, and related teaching tools and subject tools based on learning objectives, individuals, contents, styles, and scenarios(Li, 2019).

The development of education big data has made personalized resource recommendations with sufficient data support. Based on big educational data, artificial

intelligence to extract and express test questions' characteristics, establish test questions, and knowledge association network (Liu, 2018) can design and implement test question recommendation. To assist students in extracurricular self-study, and test question recommendation systems can personalize students' learning. There are good promotion and promotion. On this basis, the personalized learning recommendation model LS-PLRM (Su, 2020), which is based on students' learning situation, is more comprehensive than the test recommendation system. The model is based on a collaborative filtering algorithm and uses the learning situation's detection results to improve the recommendation algorithm. The knowledge base of the learner is analyzed to establish a knowledge map, calculate the relevance of the knowledge points, calculate the learner's learning progress and the degree of mastery of each knowledge point, calculate the recommendation of the knowledge points, and generate a personalized learning plan based on the calculation results. Recommend a personalized learning plan for learners (Su et al., 2020).

Personalized Learning Path Planning

The separation between teachers and students in the online learning space means that they are more confused than ever. They have no precise learning path planning in the face of abundant resources and have no concept of the sequence and time allocation of their learning content and the combination of learning methods. The individualized learning advantage of "freedom" turns into a disadvantage. To provide personalized learners with more effective learning support, stimulate and maintain interest in learning, and improve learning effects are not enough to recommend only resources to learners. Based on learning resources and learner analysis, we provide accurate, personalized learning path planning.

Learning path planning provides learners with a sequence of organic learning activities based on learner big data analysis results and guides learners to more effective and personalized learning. Learning includes a series of information collection processes, processing, transformation, storage, and re-creation in the digital environment. In this series of activities, the learner group has strong similarities and implicit associations and ability-oriented personality. The recommended path helps improve learning and learning efficiency (Jiang et al., 2015) to promote online learning effectiveness (Jiang et al., 2018).

The development of learner profile technology promotes the accuracy of personalized learning path generation recommendations. The accurate and personalized learning path generative recommendation model based on learning profile (Shi et al., 2019) is more in line with the learner's dynamic changes in learning level during the learning process and improves the accuracy of recommendation. Combine learning content, learning activities, and their effects into learning tuples, which are used as recommended units better to meet learners' needs (Shi, 2019).

The personalized learning path planning system can generally be divided into six parts: knowledge map, mainstream learning path, learner, learner big data, learner

portrait, and personalized learning path (Tang, 2019). The recommendation system can be the learning process is described from four aspects: learning goals, learning content, learning activities, and learning evaluation, build learner profile based on big data, build standard feature library, and provide accurate and personalized path recommendation. According to the learning objectives, with the help of textbooks and media, students autonomously or in groups to complete the learning of the basic concepts, basic graphics, and basic methods in the teaching content of this section, focusing on double-based learning and consolidating the foundation (Xia, 2020).

Personalized Learning System and Environment

As a learning model with learners as the whole main body, personalized learning has spatial separation and relative independence. In the early days, people expected to design an independent learning system to support personalized learning. The personalized learning system generally consists of a user interface, a personalized processing engine, a personalized learning process, an administrator port, and a user library. Students select courses to learn through the user interface, and the system provides personalized materials through the learning tool teaching database. The entire learning process circulates between the user interface and the processing engine.

In basic education, relying on the smart learning background basic education, building a personalized learning platform through dynamic data collection, precise learning analysis, and visual feedback can achieve personalized learning (Cao & Zhu, 2014). In the field of basic education, classroom teaching is the theme. The personalized learning platform's realization can use a hierarchical grouping of personalized learning under teachers' guidance, and intelligent learning partners can be used to promote personalized learning in an independent learning environment after class. The method provides a path for individualized learning in the field of basic education. The platform design and learning path push strategy are used in case applications. From the application data, it can be concluded that the personalized learning platform can effectively promote the dynamic and hierarchical personalized teaching of teachers, and effectively promote solving learning difficulties and improving learning motivation of different types of students. On the one hand, it helps teachers master the students' process learning data to improve teaching effectiveness. On the other hand, it frees students from the traditional problem-solving tactics and provides personalized and accurate practice materials to help students improve the efficiency of practice and achieve the maximum practice effect in a limited practice time. Teaching and learning promote each other. This helps the school improve the quality of teaching and help students improve their performance, and achieve personalized learning for students, targeted teaching (Zhao et al., 2020).

In higher education, social networks are an essential expression space for college students and a mapping of human social relationships. It contains a large amount of fragmented information of individuals in the network environment. The information has rich data connections with learners in the network learning environment. A personalized

learning environment with a social network model as a resource aggregation and recommendation framework can promote personalized learning more effectively (Yang, 2015). The personalized learning environment can aggregate personalized resources inside and outside the learning environment, analyze learning behavior data, recommend personalized learning resources to learn and provide decision support to teachers to promote learning process optimization. The development of artificial intelligence technology has promoted to be more intelligent of human-computer interaction. Researchers call the learning space in the intelligent stage of human-computer interaction a personalized learning space (Zhang et al., 2017). The core of the personalized learning space is to use personalized. The learning engine provides learners with personalized learning support services.

Conclusions and Perspectives

The increasingly apparent demands for technological innovation and individualization have prompted significant changes in school education's organizational and management modes, and homogenized education will inevitably lead to a more efficient and individualized education transformation.

(i) Individualized learning and teaching theories are gradually enriched and comprehensive, focusing on student development

The research on the theoretical level of personalized learning covers teachers' and students' roles in personalized learning, curriculum system, teaching strategies, and models, among which teaching models are the most abundant.

From the perspective of teacher-student roles, personalized learning students are the main body. The teacher's role is the guide and supporter; from the perspective of curriculum system research, personalized teaching's curriculum system can be more flexible and pay more attention to students' individual development. From teaching, individualized learning can be combined with classroom teaching, using various teaching organization forms as the central group teaching, supplemented by collaborative and individualized teaching.

(ii) Personalized learning application research pays more attention to online learning behavior

From the practical application of research content, personalized learning research is more concentrated on distance education, online learning behavior, and less attention is paid to the offline learning process. This is directly related to the difficulty of monitoring and obtaining data in the traditional teaching process. Individualized learning at the theoretical level can be organically combined with classroom teaching, but the practical level is challenging and difficult to control and is interfered with by various factors. Individualized teaching in school teaching is difficult to promote

(iii) Learning analysis technology based on big data improves the richness of learning models

Educational big data makes the data sources analyzed by learners more abundant, and learner analysis is more accurate than others. Data-based learning analysis technology has dramatically improved the quality of learning model construction. Abundant learning behavior data makes learning model features richer than ever. Various learning model-based learning resource recommendations and learning path planning services are becoming more accurate and intelligent.

(iv) The construction and application of learning models in the field of basic education need to be enhanced

As mentioned above, learners' principal place in the necessary education field to learn is still offline. Compared with universities, the available learner behavior data is relatively small, and there are fewer studies on the construction of learning models and personalized learning systems based on learning models.

With the popularization of smart campuses, accompanying detection technology and methods have entered the classroom, and the speed of intelligent recognition technology to identify paper assignments has been dramatically improved. Offline classroom learning behavior data, paper assignments, and test data have brought rich basic education big data. The value of students' classroom behavior, learning input, and academic level will help implement personalized teaching in school teaching and promote personalized education in basic education.

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ORIGINAL ARTICLE

School-Based Practice Based On Supplemental Instruction of Big Data In Education

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***Abstract**: The rise of big data technology provides direction and support for the reform and development of education. Big data technology can realize the inventory management and effective dynamic monitoring of schools, students, and teachers. It is conducive to comprehensively and accurately controlling the development of teaching activities, injecting new ideas and working ideas into teaching activities, and providing essential guidance for personalized teaching. This paper reviewed the detailed process of applying big data in education to teaching practice based on the case of a middle school in China. Furthermore, it pointed out the factors hindering the large-scale development of big data in the education field, aiming to provide directions for applying big data in education.*

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Question

WITH the innovation and development of information and communication technology, the fourth technological revolution with big data as the core has changed all aspects of people's life, work, and study in an unprecedented situation. In the context of big data, various phenomena and social behaviors can be "digitized." Big data technology can accurately identify individual needs and then provide targeted public services. This also applies to education.

The United States is a pioneer in research and the application of big data in education. As early as 2002, the U.S. government issued the "Science Education Reform Act," proposing the use of educational data as supplemental instruction decision-making. In 2009, the United States implemented the School of One program, which proposed learner-centered learning to provide learners with a personalized learning environment. In 2012, the U.S. Department of Education proposed promoting the reform of the U.S. education system by mining and analyzing big data in education, analyzed typical cases, made recommendations for implementation, and guided schools to apply big data (Zhang, 2019) effectively. Besides, big data used in education is also attracting attention in other countries. For example, Japan advocates using big data and other information technology to achieve efficient education reforms and optimize its talent structure. The European Union proposes a strategic policy of using big data in education to increase the penetration rate of education; Singapore regards big data as one of the country's key technologies and tries to adopt big data in education realizes the individualization of education.

The development of big data in education in China began with practice, and the strong support of relevant policies also laid the foundation for the growth of big data. Zhou (2020) et al. gave a detailed introduction to the development of China's education informatization. Through a series of policy formulation and resource construction measures, the Chinese government has made big data essential support for education modernization, providing the possibility for personalized learning and differentiated management, and promoting precision teaching (Xu, 2020).

However, looking at the relevant research on big data in education in China, it is found that China still has some problems with the application of big data in education. Zang (2017) mentioned that principals and other teaching managers with advanced con-

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cepts dare not implement the big data in education model on a large scale; there is no specific practice in the front line of education and the disconnection between the experts and the front line of teaching will lead to the inability and low efficiency of big data in Chinese education. Liu et al. (2016) believed that due to the uniqueness and complexity of the education system itself, big data in China education faces many challenges such as application landing, data security, data governance, and operation.

To effectively solve these problems, many schools in China have spontaneously explored the teaching application of big data in education and have accumulated some experience in the process of school-based practice. This paper took the school-based practice of a middle school in China as an example, discussed the integration path of big data in education and education and teaching, and tried to summarize the detailed process of big data in education applied to teaching, with a view to the integration of education technology and teaching to provide education with direction and support.

Practical Application Based On Big Data

In the context of big data, various learning resources and methods provide learners with learning convenience, but due to the network's intricacies, they often cause learners to lose their direction in knowledge. Therefore, this requires teachers and other educators to summarize and organize related teaching resources, adjust corresponding strategies and methods, and guide learners accordingly. In the school's teaching practice, the school cooperates with technology companies to help the school achieve personalized teaching and learning through the big data analysis platform. The actual application mainly includes the following three modules: the collection and storage of big data, the analysis and presentation of big data, and personalized learning.

Collection and Storage of Big Data in Education

The Steps of Big Data in Education Collection

The U.S. Department of Education pointed out in the bulletin "*Improving Teaching and Learning through Educational Data Mining and Analysis*" that the application of big data in the field of education mainly includes Educational Data Mining (EDM) and Learning Analytics (LA), two significant directions (Bienkowski et al., 2012). Among them, EDM is the premise of learning analysis. It is extensive use of mathematical statistics, machine learning, and data mining techniques and methods to process and analyze big data in education; through data modeling, it discovers the correlation between learners' learning results and learning content, learning resources, and teaching behavior variables, and finally predict the future learning trend of learners (Xu et al., 2013).

In school-based practice, student learning data collection is the first step and the most critical necessary work. When collecting data, teachers first need to standardize the amount and type of questions in the homework, and the knowledge points for

each question should be accurately equipped to cover the level of ability that each student can achieve. Teachers should also standardize the homework style and guide students to use A4 size loose-leaf answers on both sides to improve daily scanning work efficiency. Third, teachers should select high-precision scanning equipment to extract information to ensure that scanning accuracy reaches 100% without any omissions or errors. Among them, teachers can flexibly use various homework correction methods, which can scan first and then review online to complete the review work anytime and anywhere. Teachers can also manually review and then scan, keeping the marks of corrections so that students can review the teacher's correction ideas and summarize the improvement methods. To ensure the normalization of educational data collection, the daily, weekly, and semester phased test data can be included in the collected ranks and effectively classified according to the test's date. Let students have traces of homework completion in each period and form corresponding trends to help teachers better predict students' development in future learning activities.

Use of Big Data Related Technical Tools

In the era of big data, collecting student learning data is long-term and continuous, and the various types and complex structures of data involved in the teaching process have also become a collection trend. Therefore, traditional data storage and reading tools are difficult to adapt to more extensive data volumes, and big data technology can solve this problem. In collecting student learning data, mobile apps, WeChat applets, and online reading systems have high practicability and pertinence. They have excellent performance in diagnosing students' academic conditions, and they are potent assistants in accurately assisting teaching.

• *Mobile App and WeChat Applet*

Mobile phones have gradually become the most commonly used electronic tools in people's lives. Therefore, many technology companies develop software into mobile Apps to facilitate users' operations anytime and anywhere. Therefore, some mobile Apps have added a student learning big data system based on the digitization of textbooks independently selected by the school. A test system for student homework and test papers is prepared, systematically collecting student daily learning data, especially homework and test question data. Provide a basis for teachers' precise guidance and students' personalized learning (Jiang, 2016).

Also, in the existing related software, in order to facilitate the convenience of data collection, many companies have simplified the App into a WeChat applet, so that users can use it without downloading and installing, such as "Smart Question Book (Zhi Ti Ben)" and "Homework Helper (Zuo Ye Bang)."

In the specific operation of the school, the above two collection methods are usually shared. For example, when collecting student's protocol-guided case preview

data, students can either log in to the mobile App or use the WeChat applet to take pictures and upload the assignments. Teachers can log in to the teacher review system through a computer or mobile phone to view so that teachers can understand the students' preview in time to achieve targeted teaching.

- *Online Reading System*

This method is mainly for the collection of test scores. The scoring teacher distributes the scoring tasks through the online scoring system and efficiently completes correcting the scoring system's answers. Simultaneously, teachers' marking habits, i.e., objective questions do not need to be reviewed by teachers, subjective questions follow the original marking habits, and traditional methods such as a cross, tick, underline, and writing comments (Wu & Gao, 2019).

This operation method helps the teacher's marking work, and to no small extent, avoids marking errors or score statistics errors due to the teacher's negligence.

- *Collection Examples of Big Data in Education*

In a middle school teaching practice in China, data collection can combine "online data collection" and "offline data collection." The former collected "electronic data," and the latter collected "paper data." The freshest and creamiest real data in students' learning process can be obtained through data collection, such as traces of students' answers and teachers' corrections.

Online data collection mainly uses digital online classroom teaching platforms and learning terminal equipment to record students' questioning interaction, acquisition feedback, online homework, and other situations in online classrooms, and then generate relevant learning data. For example, to adjust the teaching progress to understand the students' mastery of knowledge points in time, teachers can publish questions on the intelligent learning platform, and the platform can quickly collect student answers after students answer on the terminal.

Offline data collection mainly reflects the entire process of students' after-school study and learning effect by recording the traces of each student's homework, weekly practice, and each exam. There are two modes of offline data collection: the data collection mode of "correction before scanning" for daily homework. Based on not changing the original learning and working mode of students and teachers, normalized data collection can be carried out, and even traces of teachers' corrections and students' corrections can be retained. The whole process is to collect students' daily homework or practice papers based on the formal review and use high-speed scanners to collect student answers and teacher's correction traces and save them to the cloud. Teachers can view the collection on the teaching diagnosis cloud platform at any time through mobile phones, computers, and other terminal apps. Moreover, students can also check their homework feedback through mobile phones and computer terminal App. The other is

that the online scoring system does not change students' original answering mode and adopts the "scan first and then correct" method for the more extensive school exams, organizing teachers to conduct centralized online scoring and synchronize the test data.

Analysis and Presentation of Big Data in Education

Analysis of Big Data in Education

• *Purpose of Analysis*

As a significant branch, big data in education has the same function as big data. The most important thing is to draw corresponding conclusions by mining and analyzing the collected data. The big data obtained through the online learning platform is massive and fragmented. Therefore, it is necessary to use technical means to summarize and filter the big data and generate valuable teaching information. In this regard, suitable analysis tools can be selected from the basic framework of distributed systems, Hadoop, Hadoop-based Hbase, Hive, Maowt, Zookeeper, Pig, and Sqoop, and data mining can be performed using classification analysis, cluster analysis, and recommendation systems. Then coordinate all kinds of related education data and extract the hidden data value (He, 2019). The analysis of big data in education analyzes the dynamic changes in students' daily behaviors from teaching data according to different scenarios and levels and promotes students' overall development. By integrating students' historical data and current data to predict their future development, education practitioners can understand students' conditions in real-time, make predictions and warnings about possible situations, and provide teachers and students with personalized resources.

• *Big Data in Education Analysis Application*

Big data in education, as education-related data, can find the weak links and deficiencies of students in the learning process after analyzing the students' learning activity data. It can also allow teachers to make better use of the situation and make more targeted suggestions to improve their learning efficiency. The information collected through the big data platform can be used to profile learners. Learner portraits are designed to finely portray each learner's individual characteristics such as strengths, preferences, and motivations, and then conduct a more objective analysis of students, thereby helping students establish more effective learning methods. Meanwhile, after big data in education analyzes teachers' teaching behavior, it can also discover teachers' advantages and problems in the teaching process and encourage teachers to improve their teaching methods.

The report "Promoting Teaching and Learning Through Educational Data Mining and Learning Analysis" (Ren & Wang, 2016) pointed out that the analysis of educa-

tional data can be applied to learner's knowledge modeling, experience modeling and behavior modeling, learner modeling and teaching strategy analysis, trend analysis, the realization of adaptation and individualization.

In school-based practice, through the analysis of big data in education, building a learner's knowledge model requires collecting interactive data between the learner and the online learning system, such as the correct answer rate, the time spent, and the error answer repeat rate. Through the data analysis of the student's online learning time, the completion of courses and exercises, the changes in learning behavior in the classroom or school environment, and the data analysis of students' online and offline test scores, the relationship between students' learning behavior and learning effect is established to help students adjust and improve the existing learning rhythm. Through the analysis of fundamental information algorithms in student online learning systems and offline, sorting out individual learning characteristics, clustering and grouping learners with similar characteristics, and finally achieving a personalized environment for different types of learners and promoting effective learning (Zhang, 2016). The establishment of this model also provides a direction for analyzing teaching strategies and student learning trends.

- *Presentation of Big Data in Education*

(i) Presentation Method

With the help of visualization technology, education data's characteristics and rules can be revealed more intuitively and clearly, and it can help discover the inherent laws implicit in the data, thereby providing a basis for decision-making. In daily teaching and management, students' learning status, corresponding behavior preferences, behavior patterns, and other information will appear quite abstract in conventional tabular or text-based displays, making it difficult for observers to clearly and thoroughly understand the importance of data transmission. However, graphical and visual displays are particularly suitable for presenting this type of data. Teachers can make in-depth and intuitive interpretations of the characteristics displayed by these data, and even without too much thinking, they can accurately judge students' status and determine guidance plans or suggestions for improvement in time (Wang, 2019).

(ii) Results are Presented in Layers

The visual presentation link can present students' information obtained through big data analysis to different followers-students, education managers, and teachers in the form of intuitive graphs or charts to understand the deep meaning of the information.

1) Presentation to Education Managers

Within the scope of the whole year, the progress analysis of the scores of the students in each class, the analysis of the average score of each class, and the statistics of the error rate of the knowledge points of the students in each class can be used as a ruler to help education managers measure their academic performance and make decisions. According to the visual chart of the performance analysis of the entire grade, education managers can clearly and intuitively read the average test score of each class, the gap between the average score of each class and the average score of each grade, and the average score of each class is in the middle of the entire grade. This is an inspection of students' learning effects and an invisible test of teachers' teaching level in each class. As shown in **Figure 1**, the education manager can conclude that the average score of classes 11, 8, 7, 4, 10, and 1 exceeded the average score of the entire grade, while the average score of classes 2, 3, 6, 9 and 5 all lagged behind the average score for the entire grade.

According to the visualization chart of the progress analysis, the education manager can examine the proportion of students in each class in each grade level and can judge the distribution of the top, middle and general students in the grade at a glance. Each class's learning tasks can be designed according to actual needs, and online courses of different gradients can be provided to each class through the network learning platform. For example, the top students' class mainly provides training to expand thinking, while the teaching of classes with more general students is still based on basic knowledge. As shown in **Table 1**, education administrators can see that although class 9 had a relatively high proportion of students in the top 10%, the proportion of students in the top 30% and 60% was deficient, indicating that the polarization within the class was relatively profound. Education administrators can use comparative data to find weak subjects where students in this class generally did not perform well in the test and can coordinate curriculum resources in a more targeted manner, adjusted the teaching rhythm, and let more general students keep up with the overall progress of school teaching activities. For another example, the top 10%, 3deficient60% of students in class 11 were among the best in the grade. Education administrators can use this class as a pilot to try innovative teaching models with higher thinking content and promote students' autonomy and creativity in learning.

2) Presentation to the Teacher

Through the visual presentation of big data analysis results, class teachers can clearly and intuitively understand their classes' scores on all question types and compare them with the grade scores. Therefore, teachers can master the current level of knowledge and ability of the students in the class and the weak areas of knowledge and ability. As shown in **Table 2**, teachers can see how each student in the class he teaches scores and loses points from questions 1 to 25. As shown in **Figure 2**, the teacher can understand that the two major knowledge points of triangle and integral form are not stable at this stage, and the scoring rate is lower than the average of the whole grade. Therefore, in future learning activities, priority should be given to the replenishment training for these two knowledge points. Under the orientation of precise teaching and research, teachers

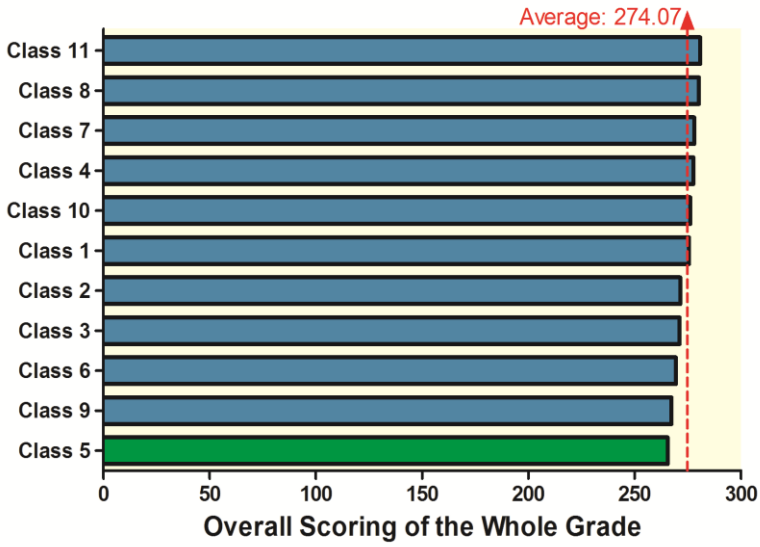

Figure 1. The Distribution Chart of the Average Grade Distribution of the Final Exam Scores of the 8th-Graders in the Second Half of the Semester of a Middle School in China.

Table 1. An Analysis Table of the Final Exam Results for the Second Half of the Semester of the Eighth Grade of a Middle School in China.

Class	Ref. #	Top 10%				Top 30%				Top 60%			
		St. #	Δ	Rate	Δ	St. #	Δ	Rate	Δ	St. #	Δ	Rate	Δ
1	44	1	-	2.27%	-	9	-	20.45%	-	30	-	68.18%	-
2	42	1	-	2.38%	-	13	-	30.95%	-	21	-	50.00%	-
3	40	3	-	7.50%	-	14	-	35.00%	-	19	-	47.50%	-
4	46	6	-	13.04%	-	21	-	45.65%	-	31	-	67.39%	-
5	43	2	-	4.65%	-	9	-	20.93%	-	20	-	46.51%	-
6	43	8	-	18.60%	-	15	-	34.88%	-	28	-	65.12%	-
7	43	6	-	13.95%	-	15	-	34.88%	-	28	-	65.12%	-
8	44	6	-	13.64%	-	14	-	31.82%	-	32	-	72.73%	-
9	41	3	-	7.32%	-	8	-	19.51%	-	18	-	43.90%	-
10	43	4	-	9.30%	-	16	-	37.21%	-	26	-	60.47%	-
11	45	14	-	31.11%	-	21	-	46.67%	-	38	-	84.44%	-
Total	474	54	-	11.39%	-	155	-	32.70%	-	291	-	61.39%	-
Max Diff.	-	13	-	-	-	13	-	-	-	20	-	-	-

Ref: Reference Student; St: Student; Δ: Change; Diff: Difference.

Table 2. Detailed Score Table of Seventh Graders' Mathematics Monthly Test in Tangquan Middle School.

C	ID	N	S	CR	GR	1	2	3	4	5	6	7	8	9-18	19	20	21	22	23	24	25
2	01	LW	78	3	21	2	2	2	2	2	2	2	2	14	15	8	3	8	6	8	0
2	02	PX	85	1	7	2	2	2	2	2	2	2	0	18	18	8	3	8	6	8	2
2	03	ZD	77	4	24	2	2	2	2	0	2	2	0	18	15	3	3	8	6	8	4
2	04	CM	61	17	65	2	2	2	2	0	2	0	2	10	6	8	5	4	6	8	2
2	05	CJ	82	2	12	2	2	2	2	2	2	2	0	14	18	8	3	8	6	8	3
2	06	MC	68	11	44	2	2	2	2	2	2	2	0	14	9	8	3	4	6	8	2
2	07	WR	68	11	44	2	2	2	2	2	2	2	0	16	15	4	3	0	6	8	2
2	08	PZ	64	13	52	2	2	2	2	2	2	2	2	10	12	4	3	4	6	8	1
2	09	CY	72	8	33	0	2	2	2	2	2	0	2	16	15	8	3	4	5	8	1
2	10	WH	72	8	33	2	2	2	2	2	2	2	0	16	15	2	5	4	6	8	2
2	11	YR	71	10	36	2	2	2	2	2	2	2	0	16	12	4	5	8	2	8	2
2	12	ZZ	53	20	76	2	2	2	2	0	2	2	0	6	6	8	3	8	0	8	2
2	13	ZS	74	6	28	2	2	2	2	2	2	2	2	14	9	8	3	4	6	8	6
2	14	GZ	62	15	59	0	2	2	2	2	2	2	0	10	12	4	3	6	6	7	2
2	15	ZJ	77	4	24	2	2	2	2	2	2	0	2	14	18	8	3	4	6	8	2
2	16	CD	63	14	57	2	2	2	2	2	2	2	0	12	6	8	3	8	2	8	2
2	17	TX	51	22	78	0	2	2	2	2	2	2	0	10	6	8	3	4	2	4	2
2	18	WY	62	15	59	2	2	2	2	0	2	2	0	12	9	8	3	4	6	4	4
2	19	YJ	54	19	75	2	0	2	0	0	0	0	2	16	9	8	3	4	4	2	2
2	20	QY	47	23	84	2	2	0	2	0	2	2	0	12	3	2	3	6	6	4	1
2	21	CY	40	24	88	2	2	2	2	0	2	2	0	5	4	4	3	4	0	7	1
2	22	LG	74	6	28	2	2	2	2	0	2	2	2	15	12	8	3	4	6	8	4
2	23	ZJ	53	20	76	2	2	2	2	2	2	2	0	10	9	4	3	4	4	3	2
2	24	LW	60	18	66	2	0	2	2	2	2	2	2	14	3	8	3	6	6	6	0
2	25	SQ	37	25	90	2	2	2	2	0	2	2	0	10	6	2	3	2	2	0	0
2	26	CD	18	26	98	0	0	0	2	2	0	0	2	7	3	2	0	0	0	0	0

Note: C: Class; ID: Student ID; N: Name; S: Score; CR: Class Ranking; GR: Grade Ranking
For the privacy, only the arbitrary ID and name are presented here.

can know their highest score, lowest score, average value, and a difference in teaching design and implementation by obtaining visual charts of relevant data from the big data in education platform.

Among them, in the student classroom learning evaluation statistics chart, teachers can not only see the scores of the class they teach but also the average scores of the entire grade and school. In the statistical map of teaching design evaluation, teachers can compare their specific scores in each teaching module to summarize each teaching evaluation's general orientation or click on the specific sections to view the specific scores. This way, it provides a basis for adjusting the teacher's next teaching method and developing the students' after-class supporting exercises. When it comes to each

Multiple Choice	Grade Score Rate	Class 2
1	88.46%	84.62%
Triangle	Wrong: 12	Wrong: 4
2	89.42%	88.46%
Power and Product Power	Wrong: 11	Wrong: 3
3	88.46%	92.31%
Propositions and Theorems	Wrong: 12	Wrong: 2
4	95.19%	96.15%
Power and Product Power	Wrong: 5	Wrong: 1
5	74.04%	65.38%
Integral	Wrong: 17	Wrong: 9
6	88.46%	92.31%
Parallel Lines	Wrong: 12	Wrong: 2
7	77.88%	80.77%
The Nature of Parallel Lines	Wrong: 23	Wrong: 5

Figure 2. Statistics of Single-Question Error Rate in a Middle School Class (Partial).

Q #	Q Type	Points	Score	S Rate	Grade Score Rate	Class Score Rate
3	Language Use	3.0	0.0	0.0%	24.0%	19.2%
9	Reading	3.0	0.0	0.0%	44.2%	42.3%
13	Reading	2.0	0.0	0.0%	57.7%	57.7%
14	Reading	3.0	1.0	33.3%	51.9%	56.4%
11	Reading	3.0	2.0	66.7%	61.9%	56.4%
4	Classic Reading	8.0	6.0	75.0%	67.3%	67.3%
8	Reading	8.0	6.0	75.0%	55.9%	60.6%
5	Silent Writing	10.0	8.0	80.0%	78.6%	84.6%
17	Composition	30.0	24.0	80.0%	69.2%	68.7%

Note: Q: Question; S Rate: Score Rate.

Problems to be Worked On

Language Use: 3

Reading: 9, 14

According to the student's performance in the exam, these incorrectly answered questions are relatively difficult and require targeted efforts by the student.

Questions to be Careful

Reading: 13

According to the student's performance on the exam, these incorrectly answered questions are relatively not difficult. The reason for the wrong answer may be that the student was careless or lacked attention.

Figure 3. Analysis Chart of the Individual Scores of a Middle School Student.

student's learning data in the class, big data shows the student's scoring situation and scoring rate for each question type to summarize the knowledge points and ability points involved. Finally, a personalized comment report for individual students is generated, which then reminds students to consolidate based on the cognitive shortcomings reflected in the data and strive to grasp all knowledge points firmly.

3) Presentation to Students

According to the visual presentation of significant data analysis results, students can understand their scoring rate and loss of points in each subject, to compare with the scoring rate of the class and the entire grade, and clarify the weak subjects that they need to work hard and check for missing points. With the system's assistance, a more targeted and personalized training plan is formulated, aiming at the error-prone and easy-to-miss knowledge points outside the scope of achieving the maximum practice effect in a limited time. As shown in **Figure 3**, the student can accurately find that his language ability and reading ability are far below the grade average and need to be strengthened; then, he will be diligent in future exercises to effectively improve his weaknesses.

Develop Personalized Teaching and Learning Plans

Using big data analysis and processing technology, it is possible to construct a student model, including student preview, classroom performance, homework, mastery of various knowledge points, and interactive communication. Teachers and parents can provide students with personalized learning strategies through the analysis of learning models. By observing their learning model, students can also discover their deficiencies and promote their ability (Jiang, 2013).

Personalized Teaching

Through data collection in the whole process of teaching and learning, big data analysis and processing technology are used to sort out the different cognitive characteristics, learning styles, and mastery of each student's knowledge points. According to students' different learning characteristics and knowledge weaknesses, individualized learning strategies and methods are formulated to achieve individualized teaching.

Teachers can classify knowledge points according to different levels of difficulty. By learning data collection and analysis technology, fully considering each student's homework test and the mastery of knowledge points, students are grouped and matched according to the three excellent, medium, and qualified levels. In class, teachers can give students questions of different difficulty at corresponding levels to meet students' individual needs, which dramatically improves teaching efficiency and truly achieves personalized teaching. Teachers can also gather students who have misunder-

stood the same knowledge point according to their understanding of the knowledge point and conduct targeted explanations and training to help students improve effectively and make rapid progress. According to the labeling of knowledge points and the analysis technology of big data, teachers can record micro-classes around high-frequency wrong knowledge points and provide them to the corresponding students so that students can "complement learning" in a targeted manner after class and solve their learning difficulties (Liu, 2020).

Each teacher will be equipped with a pad connected to the school's teaching practice's electronic whiteboard. First, teachers can use the Pad to control the electronic whiteboard content anytime and anywhere freely. For example, control the playback of PowerPoint, present electronic documents, and call electronic textbooks. Second, teachers can send teaching materials to students in class through the big data platform. For example, provide content for students to read independently, send screenshots to students, and share screens and documents. Third, the Pad can display the teacher's content and can be used to display the exercises completed by the students in the classroom and the operation process in the hands-on practical activities. For example, the objective question test in the classroom allows students to judge all multiple choice questions through the terminal and upload them directly. In the end, the system generates a statistical chart of academic conditions based on the test results of the students, showing students' common error-prone points; at the same time, teachers can also take pictures of students' problem-solving process and project them on a large screen to facilitate group commentary.

Personalized Learning Interaction

Traditional teaching can only satisfy the one-way interaction between teachers and students, and it is difficult to stimulate students' interest in learning. Therefore, it is easy to feel bored and feel lonely while studying. Moreover, the personalized learning interaction design based on big data can collect feedback information between teachers and students, students and students in time. This will make the communication and interaction transition from simple one-way communication to two-way information exchange.

- ### *Teacher-Student Interaction*

Teachers use big data analysis and processing technology to give students quick feedback on the difficulties encountered in the learning process to help them grow, prevent fear of learning, and increase their learning initiative. As for students' common problems, teachers can explain them synchronously or asynchronously according to the schedule. For individual issues, students can communicate individually. According to different knowledge points, explaining to students is also different so that any questions can be answered (Xu, 2020).

- *Student-Student Interaction*

By collecting the whole process of student learning activities and learning analysis technology, teachers can organize students with close learning styles, cognitive characteristics, and knowledge points to form an online learning group, thereby promoting student cooperation and progress. In addition to the discussion and exchange of knowledge, students can also communicate with each other emotionally, share anecdotes in life and learning experiences and insights, thereby promoting students' non-intellectual abilities.

- *Interaction between Students and Resources*

The interaction between students and learning resources is also called personality interaction. Massive online learning resources are the basis of personality interaction. However, facing the interaction of massive learning resources, students will be dazzled and lost in the world of resources. The personalized teaching of big data can collect and analyze the whole process data of students' learning activities and recommend personalized learning resources for students in line with their learning style and cognitive characteristics. It aims to help students break a clear path in the loss of resources, let students become active knowledge builders, and improve teaching quality (Wang, 2019).

In the school's teaching process, teachers can analyze students with similar academic abilities based on big data and divide them into groups. Each group has its discussion block. In class, teachers can use Pad to roll out random names and group responses to design classroom interactions; students can use Pad to ask questions, whether, in doubt or question the teacher's teaching content, they can ask. In this way, equal dialogue between teachers and students can be achieved. Besides, teachers raise the main issues for discussion in class, and students can express their opinions and opinions on the discussion platform provided by Pad on this issue, and others can refute them. Of course, students can have face-to-face discussions in class and finally upload the discussion results on the platform, and then the teachers and students can comment together. After class, the full-time teacher or group leader decides the topic and time of discussion in real-time, and the group members make adequate preparations offline and enter the discussion block to participate in the discussion within the specified time. For example, the first group discussed the topic "Group Weekly Study Plan." The group leader is responsible for notifying the other group members to discuss on time at 7:00 pm. Each group member will enter the network discussion area at 19:00. The group leader controls the entire discussion process; each member takes turns to express their opinions, and finally, the group leader supplements and summarizes the members' opinions.

Personalized Exercises for Students

Personalized exercises are different from traditional offline paper exercises. It has the following salient features: diversified practice environment, digitized knowledge carrier, hierarchical practice content, initiative in practice, high efficiency in practice, and three-dimensional process evaluation.

After studying in class, the teacher will assign homework to the students' new learning content and then assign homework to know that they do not master well and often do wrong. After a while, a particular review of the knowledge that has been learned will be conducted, and homework will be assigned according to the review content. Based on this, students' homework can be roughly classified into three categories: practice for new knowledge points, practice for error-prone knowledge points, and practice for consolidation of knowledge points.

- *The practice of New Knowledge Points*

After class, students can enter the practice system classified by knowledge points to complete the corresponding exercises. The new knowledge point is the starting point of the whole exercise. Through practice, students can consolidate the knowledge points learned in class. Simultaneously, teachers can understand each student's learning situation according to each student's work and provide targeted exceptional guidance to each student in time. The goal of the knowledge point exercise is to do all the test questions enough times. In the actual process, each student is continuously learning new content, new knowledge points and question banks are always open, and teachers are continually expanding new questions, so students will continue to have questions to do, so they are in a virtuous circle (Wang, 2019).

- *The practice of Error-Prone Knowledge Points*

After the answer is completed, the answering error will automatically enter the wrong question bank, and the attribute of the test question will change. The next time the system selects test questions, it will first select from the wrong question bank and then from the regular test question bank. By allowing students to repeat the exercises on the wrong question bank often, the system will automatically judge the question as mastered and delete the question from the wrong question bank after a certain number of correct answers to each wrong question in the wrong question exercise. If the student continues to answer incorrectly, the system will punitively increase the number of times the question needs to be answered correctly. After the students have completed all the new knowledge point exercises and wrong question exercises, it can be considered that the students have mastered the knowledge content in a short time.

- *Knowledge Point Consolidation Exercises*

When the review time arrives, the big data system will automatically select the review range and randomly select 20% of the test questions to form a test, allowing students to complete all exercises within the specified time. Among them, the questions that students make mistakes will automatically enter the wrong question bank, and the questioning mechanism is the same as the common wrong questions above (Dai, 2017).

In teaching practice, the smart learning terminal on the Pad can compare the student's loss of each item type in the exercise with other students in the class, thereby showing the weak knowledge points that confuse students and track their mastery in real-time. In addition, the personalized recommendation system on the smart terminal can capture the most straightforward points for each student and evaluate the training value of a test question in a scientific and quantitative form. After screening high-quality unit practice questions, monthly exam questions, mid-term exam questions, final exam questions, high-error questions, high-scoring questions, and other targeted and personalized questions from well-known schools and well-known tutorial books in recent years, it helps students to play steadily and quickly improve test scores. Besides, the flexible use of the personalized guidance book "One Person One Practice," which is generated based on student reports, can accurately formulate targeted high-quality remedial exercises based on students' abilities and error-prone knowledge points, freeing students from traditional problem tactics. In this way, the maximum practice effect can be achieved within the limited practice time.

Personalized Evaluation

• *The Significance of Personalized Evaluation*

Personalized evaluation is a crucial factor running through big data personalized teaching. It aims to achieve the purpose of evaluation and promotion of learning and cultivate the spirit of students who dare to learn, love learning, enjoy learning, and know-how to learn. First, through the collection and analysis of learning process data, students can adjust their own learning pace concerning their classmates' learning conditions. They can even break free from the shackles of "teacher teaches, students, learn" in the traditional sense, thereby evaluating teachers' teaching methods or making suggestions for different views of teachers' teaching strategies. Second, big data provides technical support for the development of a variety of personalized evaluation methods. Through the evaluation of groups, classes, teachers, and students, students can be evaluated in pairs. Finally, expand the space of evaluation learning, mobilize students' enthusiasm for participating in the evaluation, help students adjust learning methods, enlighten learning thinking, eliminate learning contradictions, and further promote students' personality development (Li & Li, 2020).

• *Classification of Personalized Evaluation*

In personalized teaching based on big data, the evaluation methods used include rubric evaluation, performance evaluation, and electronic evaluation plan (Zhang, 2017).

Rubric evaluation refers to a structured quantitative evaluation standard. The evaluation indicators are delineated from multiple aspects of the evaluation objectives, which are accurate, practical, and unified subjectively and objectively. In personalized teaching based on big data, rubric evaluation of related resources and knowledge helps students clarify learning objectives and requirements.

Performance evaluation is the process of creating results or completing required tasks. Personalized evaluation based on big data allows students to choose slides, electronic assignments, and videos to demonstrate their performance fully. It can help students master and consolidate knowledge better and cultivate students' practical ability and innovative spirit.

E-learning archives refer to the management of digital archives of students' homework, drawings, and grades, as well as teachers' comments. With the tracking and analysis of big data technology, we can observe and record students' learning behavior to realize adaptive learning feedback and provide personalized learning guidance. The collection and management of student learning process data can encourage students to reflect and make students more active in self-evaluation (Wang, 2019).

• *Analysis of Individualized Evaluation Examples*

In school-based practice, teachers mainly use the four aspects of curriculum content learning evaluation, participation in interactive communication analysis evaluation, examination and learning work evaluation, and extracurricular resource learning evaluation to make a comprehensive and multi-angle personalized evaluation. It aims to make sure that students can achieve the required level of learning.

The curriculum content learning evaluation standard mainly comes from the curriculum content in the personalized evaluation system and the recording and analysis of the learning database. The student's study's length, the knowledge points learned, the number of knowledge points learned, and the study notes' content.

The analysis and evaluation of interactive communication is an assessment of students' Q&A in class and the frequency of extracurricular interactions. The information points it evaluates to learners include the number of questions posted and answered on the Q&A platform, the number of questions asked by the reply, the number of selected questions obtained through evaluation, and the number of high-quality questions.

Evaluating examinations and learning works principally based on the unit exercises and examinations students usually carry out and evaluate students' learning works based on the learning content carried out in class. In the evaluation and examination modules, the evaluation elements of objective questions include: statistics on the knowledge points that students have a firm grasp and vague concepts, and score statistics on different gradient questions; subjective questions mainly review students'

knowledge group scores and content integrity. The evaluation of learning works is divided into individual work evaluation and group work evaluation. The individual works mainly evaluate students' performance and content design, while the group works evaluate students' task participation, achievement contribution, and collaboration and communication among members.

Finally, the evaluation of extracurricular resources learning mainly evaluates learners' curriculum development resources in the informal learning process. It refers to the knowledge points of text courses, the number of on-demand video courses learned on the students' extracurricular learning platform, and the frequency of online reading and resource download to comprehensively inspect the intensity of students' independent learning after class.

Concluding Remarks and Perspectives

Studies have shown that information technology has played a certain role in students' academic performance (Fang & Huang, 2019; Li, 2019). Based on the understanding and application of big data, this article conforms to the actual needs of teaching activities and points out the supplemental role of big data in actual teaching. With the advent of the significant data era, large-scale online education data can be refined through data collection and analysis, and massive data can be collected, processed, analyzed, mined, predicted, and presented. In turn, it promotes the reform and development of education and teaching practice, brings high-quality feedback and personalized customization to learning and education that are different from traditional models, and realizes the all-round development of students in the real sense. In general, big data in education can meet online user management and learning needs and provide an indispensable supplemental role for education, teaching, and research.

However, the promotion of big data in the education field has also ushered in a number of opposition or doubts. First of all, big data technology requires an exceptionally high quality of people themselves. Data science is a subject that spans multiple fields. Big data practitioners must also possess intricate knowledge in multiple disciplines, such as Internet technology, informatics, and statistics, which is extremely difficult to train and has a high entry barrier. Therefore, in the basic education stage, the combination of schools and big data technology companies has become a trend, but the integration under this trend has become another dilemma in developing education.

Secondly, large-scale data analysis and processing are usually challenging to complete with personal power but need to be carried out in the form of a multi-person division of labor under a team system's constraints. In school practice, to complete a school-wide student data analysis requires the cooperation of teaching groups and information technology teachers in all grades. Especially in data collection, many teachers complained a lot because of the heavy collection workload at the beginning of school practice. In the later practice, through continuous improvement attempts, a data collection method with multiple collection methods coexisting gradually formed, and the situation has improved.

Data interoperability difficulties, lack of data format standards, data security, and privacy leakage technical issues will also hurt big data technology. At present, big data still has significant defects in the collection, storage, management, and use of user information. Therefore, if you are not careful, you have to hide or terminate the use. These shortcomings cause significant data development costs in education to be too high, so it is not suitable for large-scale promotion and use (Zhang, 2016). This is also an issue that the school has always emphasized in its cooperation with educational technology companies. It is necessary to strengthen the information protection in collecting, storing, managing, and using student data to ensure student information safety to the greatest extent.

The integration of big data technology and education is considered an effective way of education reform and development. Excellent application cases continue to appear during the integration process. In the school-based practical process, they use new ways of thinking and methods to break through the traditional teaching model's bottleneck. These excellent school-based practice cases also provide references and a basis for the application and development of big data education.

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