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Research on the Equity of Physics Course Resource Allocation under Online Education Platforms

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Abstract: This study examines the equity of physics course resource allocation in online education platforms. Through analyzing China's current online education landscape, it identifies key challenges including uneven resource distribution, heavy reliance on technology, significant economic influences, and inadequate fulfillment of personalized needs. The research explores the root causes of resource inequality—economic disparities, geographical constraints, technological barriers, and policy/standard gaps—while applying fairness theories to address the core issue of ensuring equitable access to quality educational content. Key recommendations include optimizing resource allocation mechanisms, advancing technological innovation, enhancing teacher training and support, and prioritizing student-specific needs to achieve balanced distribution of online educational resources.

1. Introduction

Educational equity is the foundation of social equity. With the development of network information technology, the use of computer and communication technologies to achieve various media methods in the teaching process is collectively referred to as distance education. Teaching activities conducted through these means are called distance education, also known as online education or virtual schools. Due to the characteristics of this new teaching form, such as being unrestricted by time and space and its ability to formulate personalized learning plans based on students' learning situations, it has become an important tool for promoting educational equity. Although a certain number of multimedia classrooms have been established in primary and secondary schools in China, many middle schools in remote areas still lack modern teaching equipment and qualified teaching staff. Physics is a fundamental discipline of natural science, playing an irreplaceable role in cultivating students' innovative abilities and improving their scientific and cultural literacy. How to reasonably allocate physics education resources so that every child can have an equal opportunity to receive education is one of the urgent problems to be solved. Based on this background, this paper discusses the issues related to the equity of physics course resource allocation under online education platforms, analyzes the main influencing factors and their causes in this process, thereby providing a reference basis for future improvement efforts.

2. Literature Review

2.1 Research on Resource Allocation Equity

The measurement standards for resource allocation equity can be quantitative or non-quantitative. Quantitative standards, represented by the Gini coefficient, convert the quantity differences of a specific resource within a particular group into specific numerical values to reflect the degree of inequality. Non-quantitative standards, represented by Pareto efficiency, evaluate the state of various resources in a region or overall system to judge whether there is room for optimization in resource distribution and how to achieve optimal allocation. For the latter, qualitative analysis is generally adopted, such as assessing whether the design of the resource allocation system is scientific, standardized, open, and fair, whether information transmission and access channels are smooth throughout the process, and the breadth and depth of public participation. This series of subjective evaluations is also part of research on resource allocation equity. For example, in Liu Xin's article[1], although no specific data was presented to concretize the concept of resource allocation, the author pointed out that uneven economic development levels have led to varying quality of educational resources across regions in China, especially in remote rural schools, where teaching hardware facilities are relatively rudimentary and teaching resources are scarce and poor compared to urban educational environments. This indicates that at the current stage, many problems in resource allocation still exist, and this gap is relatively large. Therefore, future research should pay more attention to this issue and provide reasonable solutions, which will be conducive to truly improving teaching quality and enhancing students' learning abilities.

2.2 Research on Equity of Online Education Resources

Judging from the distribution of resources, high-quality online education resources are mainly concentrated in large and medium-sized cities and relatively affluent areas, while resources in rural or remote areas are severely lacking. Children in these areas do not have equal opportunities to receive a good education, further widening the urban-rural gap and increasing social wealth disparity. For instance, Fang Taisen and Qu Zaofang[2], in their discussion on the design and implementation of education platforms in impoverished areas, explicitly stated that impoverished counties generally suffer from weak teaching staff, low teaching levels, and poor teaching quality, leading to low educational quality. Moreover, due to unreasonable allocation of educational resources, the hardware facilities of many schools cannot keep up with the times. Simultaneously, objective reasons such as remote locations and information isolation result in very scarce local educational resources, creating a situation of extreme educational resource shortage. This shows that the phenomenon of uneven educational resource distribution among regions is an important reason affecting people's equal access to high-quality online education resources.

2.3 Research on Physics Course Resources

Physics course resources refer to various possible teaching environments or material conditions provided to achieve the expected physics teaching objectives[3]. They mainly include textual course resources (textbooks, exercise books), laboratory course resources (conventional resources: experimental equipment, specimens, unconventional resources: multimedia computer classrooms, network systems, CAI software, web pages, etc.), and also human resources (expert professors, student parents, ordinary teachers and students), and location resources (flora and fauna in natural geographical environments, machinery factories in industrial zones, exhibits in museums, etc.). Liu Xin, considering the characteristics of current rural junior high school students, analyzed the current

situation of physics course resources in rural junior high schools against the backdrop of the ‘Internet’ era and proposed corresponding countermeasures and suggestions, aiming to better solve the problem of insufficient physics course resources in China's rural junior high schools, thereby promoting the development of the new round of basic education curriculum reform and improving the quality and abilities of rural middle school students.

3. Current Status of Physics Course Resource Allocation under Online Education Platforms

3.1 Uneven Resource Distribution

Judging from the current state of resource development, among the high-quality physics teaching resources established in China at this stage, they are mainly concentrated in some prestigious universities and resources from some large and medium-sized schools in economically developed regions. In contrast, teaching resources in general institutions and primary and secondary schools in underdeveloped areas are relatively scarce. Currently, the dozens of national-level high-quality courses launched by the Ministry of Education and their instructors' affiliated institutions, as well as renowned lectures on physics subjects provided online by several famous key universities in China, are mostly concentrated on a very small number of websites or in individual provinces and cities. This has led to an imbalance in the opportunities for students in different regions and various types of schools to access learning resources.

3.2 High Technological Dependency

Online teaching systems primarily rely on computer networks for data transmission and interaction. Therefore, network stability and internet speed will directly affect the normal operation of distance teaching systems and have a significant impact on the sharing of physics course resources. Due to uneven geographical distribution and differences in economic development levels, many schools in western China are located in remote mountainous or pastoral areas with backward communication facilities and limited coverage, resulting in many places still unable to meet basic internet needs. For some economically underdeveloped regions, even if they can access the internet, network outages often occur. These situations prevent many teachers and students from stably logging into online education platforms to obtain high-quality educational resources. Furthermore, certain physics experiment demonstration courses (e.g., electric spark timer, double-slit interference) and virtual simulation course content (e.g., Doppler effect) require high bandwidth and relatively high network quality as support. Therefore, students without a good network environment find it difficult to master corresponding knowledge through this form of learning.

3.3 Significant Influence of Economic Factors

Family economic level is an important factor affecting students' access to high-quality physics education resources. Generally, in economically well-off families, parents can provide their children with more high-quality online physics courses and hardware facilities. In contrast, in families with relative economic difficulties, they often cannot afford various expensive online physics courses or extracurricular tutoring classes and related equipment expenses. This leads to greater educational inequality among students. For example, many excellent physics experiment videos or personalized learning guidance that require payment are inaccessible to students from impoverished backgrounds.

3.4 Insufficient Fulfillment of Personalized Needs

Currently, the online physics courses provided by major mainstream online education platforms are designed, produced, and promoted in a standardized manner. They fail to provide corresponding differentiated guidance based on each student's different learning ability levels and individual characteristics and cannot offer practical and operable suggestions tailored to each individual. Meanwhile, the massive number of online physics courses available on various online education platforms also suffers from severe homogenization. Although they provide users with a rich range of course choices, they neglect effective analysis of students' personal characteristics. This situation causes many high-quality online physics courses to be buried in the vast ocean of information, failing to be effectively utilized or used, resulting in significant waste.

4. Factors Influencing the Equity of Physics Course Resource Allocation under Online Education Platforms

4.1 Economic Disparities

Due to differences in economic capabilities, students' family backgrounds vary, leading to differences in the family educational resources they can utilize during online learning. For example: students from high-income families have access to better hardware facilities and broadband internet services and can obtain excellent physics tutoring materials or extracurricular books through various channels. Conversely, students from low-income families struggle to obtain a good learning environment or high-quality tutoring materials.

4.2 Geographical Limitations

Different geographical regions have different development situations, resulting in unbalanced development among various localities, especially a significant urban-rural gap. Firstly, the level of network infrastructure construction varies greatly among regions. Network coverage in many rural and remote mountainous areas is relatively low, and internet speeds are slow, causing great inconvenience for teachers and students using online education platforms.

4.3 Technological Barriers

The allocation of educational resources among regions is also unbalanced. Some developed cities have strong financial support to cultivate a large number of excellent teachers, introduce a large amount of advanced teaching equipment and technological means. However, some impoverished and backward areas lack sufficient funds to invest in establishing good education systems and equipping advanced instruments and equipment.

4.4 Lack of Policies and Regulations

The economic development levels between eastern and western China are vastly different, with the eastern coastal areas being relatively affluent and the western inland provinces relatively poor. This results in an overall imbalance in economic development between the north and south. This huge wealth gap directly affects the balanced allocation of educational resources, leading to an increasingly serious digital divide nationwide. That is, residents in some areas cannot enjoy the convenience and development opportunities brought by modern information technology, which severely affects local economic and social development processes.

5. Strategies to Promote Fair Allocation of Physics Course Resources under Online Education Platforms

5.1 Strengthen Policy Support and Guidance

From a macro perspective, the problem of teaching inequity in physics education under the online education environment requires corresponding support and assistance from the state. Support for the sharing of high-quality physics course resources on online education platforms should be strengthened, financial support increased, and investment and construction efforts intensified in economically backward rural and remote mountainous areas. Their hardware facilities (such as networks) should be improved to ensure they can enjoy good network conditions for convenient use. For some excellent online education platforms, they should be actively guided to distribute high-quality physics course resources to areas or schools with weak foundations, allowing more children to benefit from these high-quality course resources.

5.2 Optimize Resource Allocation Mechanisms

Establish a scientific, reasonable, and effective physics course resource allocation mechanism. Precisely configure various types of courses based on regional differences and inter-school gaps. Use big data analysis to understand students' knowledge structures, learning habits, and preferences, providing direction for resource development. Build sharing and exchange platforms to open high-quality physics course resources for wider use, breaking geographical limitations and time-space barriers, and promoting the radiation of excellent teaching achievements to broader fields. For example, the National Primary and Secondary School Smart Education Cloud Classroom collects high-quality lesson video examples from all over the country, available online for free viewing by teachers and students nationwide.

5.3 Enhance Technological Level and Innovative Application

Promote and support network-based technology research, development, and use, lowering technological entry barriers. Promote research and innovation in physics subject teaching content and technological means using new generation information technologies represented by artificial intelligence (AI), big data, and virtual reality (VR). For instance, establish and improve AI-assisted teaching design models or algorithms in the physics field, and combine human-computer interaction technology and multimodal information processing technology to build intelligent, personalized (automated push based on learner profiles) physics education resource management systems, providing users with more convenient service experiences. Furthermore, online education and teaching platforms should rely on the massive computing power and storage space provided by cloud computing technology, introducing advanced computer graphics and virtual reality technology into physics course development, possess certain data mining capabilities, and utilize data analysis technology to achieve functions such as physics knowledge graph construction and teaching process monitoring and analysis, thereby forming a data-driven decision-making mechanism applicable to practical scenarios. At the same time, explore new "Internet+" smart classroom models, build adaptive learning service platforms including intelligent recommendation engines and intelligent test question banks, carry out virtual simulation inquiry activities, thereby enhancing the overall quality and richness of online high-quality physics course resources.

5.4 Strengthen Teacher Training and Support

Professional teaching staff, mainly frontline physics subject teachers, are needed in the development process of online education resources. The cultivation of physics subject teachers' information awareness should be strengthened, and their ability to use modern information technology should be improved. This will help promote the effective utilization of middle school physics course resources and ensure the smooth achievement of the goal of high-quality and balanced development. Additionally, efforts to train physics teachers in remote areas, especially in underdeveloped western regions, on their information technology level and online education teaching design capabilities should be increased. This will enable the majority of teachers to fully leverage the advantages of online education, i.e., achieving maximum resource allocation benefits through sharing high-quality course resources, thereby further improving teaching quality and reducing cost inputs.

5.5 Pay Attention to Students' Personalized Needs

An object-oriented teaching design philosophy should be established. Based on attention to individual student differences, emphasize teaching students according to their aptitude throughout the curriculum system. Combined with the multimedia network environment, build an open physics platform suitable for high school students to independently choose learning content and methods. This system adopts a one-on-one model, i.e., tailoring a set of information service plans and corresponding support tools and service processes that conform to their characteristics and needs for each user. Establish student learning profiles, record students' learning processes, and use this data to analyze students' current knowledge structure, mastery level, existing problems, personal interests and hobbies, etc. This can help teachers more accurately grasp students' ability status and development trends, and based on this, provide targeted help and support for each student, achieving true individual tutoring and enabling it to better serve students' development.

6. Conclusion

While online teaching platforms bring new opportunities for physics course resource allocation, they also face many challenges, such as: economic disparities, geographical limitations, technological barriers, and lack of policies and regulations, which affect the fair allocation of physics course resources. To promote the fair allocation of physics course resources under online education platforms, joint efforts from the government, enterprises, and all sectors of society are needed. This includes strengthening policy support and guidance, optimizing resource allocation mechanisms, enhancing technological levels and innovative applications, strengthening teacher training and support, and paying attention to students' personalized needs. Through the implementation of these measures, gradually reduce the huge gaps between different regions, various types of schools, and different student groups, enabling them to have more equal opportunities when receiving knowledge, so that they can all obtain good development opportunities.

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