

The impact of the digital divide on educational equity

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Abstract. In recent years, the impact of the digital divide on education equity has been widely acknowledged. This paper analyzes the specific performance of the digital divide in the field of education from three dimensions: the inequality of digital access, the gap of digital literacy, and the difference in home online education learning environments, and explores its far-reaching impact on education equity. The analysis shows that the digital divide not only leads to the inequality of learning opportunities and the gap of learning effect, but also further aggravates the solidification of social and economic classes. Based on this, this paper puts forward the following suggestions: the government should strengthen policy guidance and infrastructure construction; Relevant departments and institutions should carry out digital literacy education; All sectors of society, such as technology companies and non-profit organizations, should work together to alleviate the digital divide.

1 Introduction

Against the backdrop of rapid global technological development and the increasing popularity of the Internet, people around the world are enjoying the convenience brought by digitalization. However, the impact of the digital divide has also permeated into various fields [1]. The digital divide refers to the inequality of social, economic, and educational opportunities caused by differences in technology ownership, application, and innovation capabilities among different groups. In the field of education, developing countries and marginalized groups suffer huge obstacles due to the lack of digital infrastructure, which seriously affects their equal access to modern educational resources [1]. With the increasing popularity of online education, although it is considered an effective way to narrow the educational gap, if the digital divide problem is not effectively solved, it may exacerbate educational inequality and widen the social gap. Therefore, exploring how to address the challenges posed by the digital divide to educational equity is of great significance not only to improve the equity and accessibility of education, but also to effectively narrow the social gap. In the field of education, a large number of studies have explored the issue of the digital divide. For example, scholar Wang Zhenzhen's research indicates that the digital divide is significantly reflected in the differences in efficiency with which various groups utilize the Internet and information tools both inside and outside the classroom [2]. In addition, scholars such as Xue Eryong and Fu Wangqian proposed in their research that differences in online

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education information equipment and learning environments, among others, are also a major manifestation of the digital divide problem [3]. However, existing studies focus on the basic form of the digital divide, that is, the existence of the digital divide and its manifestations, but there are major deficiencies in exploring how it specifically affects the educational opportunities and academic success outcomes of different groups and proposing targeted solutions. Therefore, based on existing literature, this article will analyze the main reflections of the digital divide in the field of education, explore its impact on educational equity in depth, and propose possible solutions.

2 Main manifestations of the digital divide

2.1 Digital access inequality

There is a significant imbalance in Internet access. On the one hand, in many countries, there is a big difference in network coverage between rural and urban areas. Some remote areas have not yet popularized 5G networks and rely on 2G or 3G networks. The network speed is severely limited and cannot support modern educational needs such as online high-definition courses, exams, and online resource acquisition. They have to rely on traditional paper textbooks or locally stored materials. On the contrary, urban students with high-speed networks can more conveniently obtain high-quality online learning resources to meet their needs. On the other hand, there is a significant gap between developed and developing countries in terms of investment in digital infrastructure such as fiber optic broadband. According to relevant reports, hundreds of millions of children worldwide lack access to the Internet [4]. In developed countries, 81% of the population can connect to the Internet, which is more than twice the proportion in developing countries, and in the least developed countries, this figure drops to just 15% [4]. Additionally, in Africa, three out of five young people aged 15 to 24 are unable to access the Internet, whereas in Europe, only one in twenty-five faces the same issue [4].

There is significant inequality in access to equipment. On the one hand, there is a large difference in the ownership of electronic devices between low-income and middle- and high-income households. Children from relatively poor families tend to share an electronic device with their parents and have less time to spend on their studies. In contrast, children from relatively affluent families often have a full range of different electronic devices, such as cell phones, tablets, and computers, which allow them to access online educational resources at any time. In addition, these families are often able to provide their children with additional electronic learning aids such as e-readers. On the other hand, educational institutions vary in terms of the adequacy of their facilities. Private schools in developed countries often have modern computerized classrooms, while many public schools still rely on older hardware. For example, modern classrooms are usually equipped with smart teaching panels, which can be used by teachers to play educational videos or conduct virtual reality demonstrations, making abstract concepts more intuitive and vivid, promoting students' understanding and memory, and improving learning outcomes. However, students in poorly equipped schools do not have the same learning experience.

2.2 Digital literacy gap

Students from different backgrounds have different levels of proficiency in using online learning tools. Students from economically better-off families are generally exposed to smart devices earlier, enabling them to use various online learning tools proficiently. However, students from relatively poorer families mainly learn through paper books and are less

familiar with digital platforms, which puts them at a disadvantage in the use of technology. For example, when online learning is required, some students in the United States lack the skill to join Zoom calls and team up with each other in shared Google Docs [5].

2.3 Differences in the learning environment of online education at home

There is a significant gap in the level of family education awareness in online education. There are significant differences in educational concepts, methods, levels, and final educational outcomes among families in different regions, economic and social backgrounds, and types [3]. Some parents focus on using online network resources to enrich and improve their education concepts, and provide effective guidance in the process of their children's online learning, such as helping them manage learning time, understand online learning content, and solve difficult problems. In contrast, some parents underestimate the importance of online learning today and lack the awareness of actively obtaining educational resources, resulting in the inability to provide necessary help for their children. In addition, coupled with factors such as family work pressure and time allocation, many parents do not pay attention to providing long-term companionship and supervision for their children's online learning. According to the survey, only 23.4% and 29.6% of parents can always accompany or often accompany their children in online learning, and 74.81% of parents supervise and remind their children for online learning [3].

3 Impact of the digital divide on educational equity

3.1 Unequal learning opportunities

Students from low-income families cannot participate in distance education fairly. Students from low-income families cannot fully participate in online learning due to their poor family economic conditions and difficulty in purchasing expensive electronic devices. Even if the Internet provides high-quality online resources, they are still excluded from this education model [6]. In addition, in today's era of rapid digital development, the lack of long-term experience in the use of electronic equipment may lead to their low timeliness in using these online learning platforms, which further exacerbates the inequality of learning opportunities.

The distribution of open education resources is uneven, failing to genuinely benefit all students, particularly those in remote regions. Many open educational resources, such as e-books, online courses, and academic papers, require a high level of internet stability. However, in many remote areas, network infrastructure is poor, and there are even cases of prolonged internet outages, making it difficult for students to efficiently search for and access online learning materials.

3.2 Gaps in learning outcomes

Students with unstable networks and fewer devices have great difficulties in distance learning, which widens the gap in academic performance. These students often have difficulty watching course videos or participating in real-time classroom discussions, missing out on key knowledge points and important explanations, which can directly affect their academic performance in the long run. For example, during the period of online learning, students with limited access to online learning resources missed the content required by the course, and also missed the opportunity to learn additional skills, expanding the use gap [6].

Different levels of family awareness of online education will lead to a large gap in the students' learning effect. Students with relatively weak awareness of online education at

home often lack effective guidance from their parents during their online learning. In this case, students often lack clear online learning goals and plans, and spend more time online for recreational activities rather than learning and skill improvement, which affects their academic development to a certain extent. On the contrary, in families with strong concepts of online education, parents can usually use their higher level of educational digital literacy to actively guide their children to use online learning resources, help and supervise them to reasonably plan online learning time, develop autonomous learning ability, acquire more knowledge and skills, and promote the improvement of academic performance [3].

3.3 Long-term Effects: The solidification of social and economic classes

The difference in access to online educational resources leads to large differences in learning outcomes and future development levels among students of different groups, and the gap between the rich and the poor is further widening, especially in the context of the increasing demand for digital skills. For example, due to the imbalance of digital educational resources, students from low-income families are often at a disadvantage in the college entrance examination and university application process, making it difficult for them to be admitted to top universities, affecting their career development. At the same time, under the background of the rapid development of digital technology, highly paid occupations often have high requirements for personal technical ability and digital literacy. However, due to the lack of relevant digital skills training and small core competitiveness, poor groups are usually difficult to enter the elite career circle, which has seriously affected their personal development, further widened the gap between the rich and the poor, and hindered social mobility.

4 Possible Solutions

4.1 Policies and Infrastructure Construction

The Government should formulate feasible and effective policies to further improve infrastructure development and ensure equal and effective access to digital education resources for different groups of students [7]. For example, a state government of India introduced a provision of 2 GB of free mobile data to the students from the government and government-aided colleges, which has great potential in addressing the network access problems faced by many students, allowing different groups of students to keep up with their studies and ensure the quality of their learning during the period of online learning [7]. Additionally, the government of India, has provided effective support to rural students who struggle to access online education consistently by regularly updating the schedule and content of the educational TV channel Kalvi TV and increasing the frequency of replays, and these efforts have expanded its reach, enhanced its accessibility and reliability, and helped mitigate educational disparities caused by the digital divide [7]. The government can also implement economic subsidies and other related policies, increase economic support for low-income groups, and enable these families to purchase necessary e-learning equipment.

4.2 Popularization of digital literacy education

Relevant departments and institutions should develop digital skills training for learners to help them acquire and improve digital literacy, so that they can more effectively access and use educational resources provided by smart media [8].

Parents of students should also receive the necessary digital literacy training. Parents should strengthen their own culture and awareness of online education, master the basic digital equipment technology operation, information screening, and the use of online education resources, more effectively support, accompany, and supervise their children's learning, and further improve students' learning effect.

4.3 Social synergy

Bridging the digital divide also requires the cooperation of all sectors of society to provide a strong guarantee for promoting educational equity. On the one hand, large technology companies such as Google and Microsoft can offer low-cost or free online educational resources to the public. In addition, enterprises can also deepen their cooperation with schools and educational institutions to jointly develop digital education products and solutions suitable for teaching environments to better meet diverse educational needs [9]. Such measures enable students in low-income and remote areas to receive high-quality e-learning courses, enhance their social competitiveness, and gradually effectively alleviate the digital divide and narrow the social gap. On the other hand, non-profit organizations and non-profit programs should also make their due contributions to educational equity. For example, One Laptop Per Child (OLPC) is a non-profit organization that provides low-cost educational computers to children in developing countries, and is committed to providing equal digital education opportunities to any learner worldwide [10]. And the organization develops child-friendly learning software to assist students in accessing more valuable educational resources [11]. In addition, a non-profit project called "Computers at Home" refurbishes donated second-hand computers and provides them free of charge to families with fourth-grade students [12]. Moreover, the project collaborates with two internet service providers to offer these families affordable internet access [12]. With the mission of "bridging the digital divide", the project has distributed over 12,000 computers to families since its inception, averaging approximately 600 computers per year [12]. Such initiatives likewise enable more people to access digital education and resources, promoting digital equity. To sum up, the full support of all sectors of society can provide more digital resources and technical support for vulnerable groups, and effectively contribute to the construction of a more equitable education environment.

5 Conclusion

This paper explores the specific manifestations of the digital divide in the field of education and its profound impact on educational equity, and also proposes multi-level response strategies for these issues. Traditional research mainly focuses on the existence of the digital divide and its basic characteristics, but there are major deficiencies in exploring how it specifically affects the educational opportunities and academic outcomes of different groups and proposing targeted solutions. In terms of specific manifestations, in addition to the imbalance in Internet access, unequal access to equipment, and gaps in digital literacy, this paper further explores that differences in family online learning environments are also an important manifestation of the digital divide, pointing out that families from different socioeconomic backgrounds and regions have significant differences in educational concepts, learning support, and final educational outcomes. In terms of far-reaching impacts, this paper analyzes how these issues exacerbate inequality in learning opportunities, differences in learning outcomes, and further lead to the solidification of socioeconomic classes, emphasizing that relying solely on online education cannot automatically bridge educational inequality, but may instead exacerbate social stratification due to the existence of the digital divide. Therefore, in terms of response measures, policymakers should first strengthen policy

implementation and infrastructure development to enhance digital education accessibility in underdeveloped areas. Students and parents should work together to improve their digital literacy to better adapt to digital learning environments. All sectors of society, such as technology enterprises and non-profit organizations, and projects, should also contribute to the development of cost-controllable and sustainable digital education solutions to make up for the lack of government resources. However, narrowing the digital divide still faces multiple challenges, such as the accessibility of advanced technologies, the effectiveness of policy implementation, and data security concerns. Future research could further explore ways to reduce the costs of technological applications to make educational resources more inclusive, improve policy enforcement, and ensure data privacy and security while promoting educational innovation. Only through the joint efforts of policymakers, schools, families, and society can the digital divide be truly bridged, leading to a fair and sustainable education system.

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