

An Overview of the Evolution of IT-Enabled Education Policy and Practice in the United States

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Abstract: Since the 1990s, with the booming development of computer and other Internet information technology, the impact on the field of education has become more and more profound. Around the world, vigorous development of information technology in education has become a common trend. By systematically reviewing and sorting out the policies and bills of IT-enabled education in the United States at various stages, the article divides the historical process in the field of IT-enabled education in the United States into three stages: exploration and enlightenment (1983-1995), gradual enhancement (1996-2009), and deepening innovation (2010-present), and systematically summarizes the four major characteristics of IT-enabled education. The vigorous development of information technology in education in the United States has, to a certain extent, promoted the development of education and become the pioneer and leader of information technology in education worldwide, and its professional standard ranks among the top in the world.

1. Introduction

Since the 1990s, with the booming development of computer and other Internet information technology, the impact on the field of education has become more and more profound. Worldwide, vigorous development of information technology in education has become a common trend. Before information technology was widely used in the field of education, the main goal of education in the United States was to achieve compulsory education for all and to help the poor. Under the impact of events such as the Soviet satellite in 1957 and the dramatic decline in the quality of education in the United States, the United States began to have a sense of crisis about the future of education, and the U.S. government began to pay more attention to the development of science and technology and information technology education. The U.S. government successively formulated various policies and regulations and began to intervene directly in national education, and formulated a series of policies and practical measures to promote the development of national information technology education in specific situations.

2. The policy evolution of IT-enabled education in the United States

2.1. 1983-1995: Exploration and Enlightenment Phase

In the late 1970s, the quality of education in the U.S. plummeted, and the U.S. authorities and the public were convinced that education reform was imperative. In April 1983, the U.S. released the report "A Nation in Crisis: The Education Reform Imperative," which particularly pointed out the threat to U.S. basic education in the era of rapid development and aroused the high attention of the U.S. government. Since then, the U.S. government has brought education reform to an unprecedented strategic level.

On a national level, the first U.S. policy to use information technology in basic education was Science for All: Science for All-Project 2061 of USA, developed by the American Association for the Advancement of Science organization in 1985. The plan uses a computer-based teaching model that combines major curriculum blocks to improve students' knowledge base about information technology, with the expectation that every student across the United States will be able to develop in the development of technology and social life[1] In 1991, the Bush Administration released the American 2000: An Education Strategy, which proposed the creation of a nationally unified education information system designed by a team of federally organized experts to provide practical, reliable research results, electronic textbooks and other educational materials to U.S. schools.[2] In 1993, the Clinton Administration announced the official implementation of the "Information Superhighway" program proposed by Vice President Burt in 1992 and renamed it the "National Information Infrastructure" program, and the concept of "information technology in education" was officially introduced. The concept of "information technology in education" was officially introduced. This plan increased the investment in the infrastructure of information technology education in the United States, with the purpose of building a "highway" between information and the network, so that the majority of students can get more educational resources. Since then, with the implementation of education information technology strategy, teachers began to have different degrees of difficulties in using new teaching technologies and methods. In 1995, a professional educational technology expert group was established to provide the President with a set of guidelines and recommendations on K-12 education, in conjunction with the then latest report on the use of information technology in education.

At this stage, IT-enabled education in the U.S. is still in the nascent development stage, and a series of policy documents have been issued to match the educational reform, such as "Linking K-12 Schools and the Information Superhighway," "Teachers and Technology: Making the Connection," "Benchmarks for Scientific Literacy," and "Technology Literacy Standards: The Content of Technology Learning. A series of implementation countermeasures have been proposed for the infrastructure facilities and teacher levels of empowered education, laying an objective foundation for the next phase of application and enhancement.

2.2. 1996-2009: gradual upgrading stage

The continuous development of education technology in the field of basic education has brought a broad prospect for IT-enabled education. [3] The U.S. government, in order to meet the needs of IT education development in the new era and continuously improve the use of IT in education, has started to release a series of spiraling and constantly innovative National Education Technology Plan (NETP) in order to accomplish structural changes in the field of education through the support of IT.

To provide financial and technical support for students in disadvantaged areas to receive IT education, in 1996, the U.S. Department of Education released the first edition of NETP - Getting

America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge. Since then, it has been promoting information technology in education and further strengthening teachers' technology training and the use of educational technology. However, due to funding problems, it was not widely used throughout the United States, so the U.S. Congress passed a program called "E-rate" in the same year, which aims to provide 20-90% discount for schools and libraries that are less developed, and to provide each school with easy access to the Internet.[4] In 1997, the U.S. Department of Education began building a second-generation information network, releasing a special report entitled "U.S. Department of Education Strategic Plan 1998-2002," which stated that by 2001, all U.S. schools would be effectively equipped for daily instruction and all classrooms would be connected to the Internet. At the same time, students with disabilities and low-income families can learn with high-quality technology support[5] The plan is to ensure the effective implementation of this plan. In 1998, the U.S. government invested \$51 billion in education information technology infrastructure, which has helped to advance the implementation of NETP. In 1998, the U.S. government invested \$51 billion in education information technology infrastructure, which strongly promoted NETP implementation. In 1999, a study by the U.S. Department of Education and other departments found that the goals of education informatization set by NETP 1996 had basically been achieved. However, there was still a gap between education technology and the economic development at that time, so in 2000, the U.S. updated NETP2000, "E-Learning: Putting A World-Class Education at the Fingertips of All Children," which introduced the concept of "digital learning" for the first time. NETP2000 aims to further improve basic education facilities and ensure that every student has access to a world-class education. To ensure that information technology can effectively promote student learning, the "No Child Left Behind" Act passed by the U.S. Congress in 2002 and the "US Department of Education Strategic Plan 2002-2007," both emphasize that relevant departments should focus on building educational information technology for low-income families, as well as using information technology to improve the English proficiency of students who are less proficient and to reduce the educational gap between children from disadvantaged groups and mainstream society. education gap.[6] After several years of implementation, in order to further improve IT-enabled education and to face the problems of teacher shortage and how technology can compensate for the lack of learning experience and knowledge, the U.S. government began to convene prominent principals, IT experts, and other related personnel in 2003 to start developing NETP 2004. finally, in 2004, the Bush administration released NETP 2004, "Toward a New Golden Age in American Education: How the Internet, the Law and Today's Students Are Revolutionizing Expectations," which proposed the need to strengthen teachers' sense of innovation and their ability to use it, vigorously promote digital education and virtual campus construction, and promote the full use of digital materials by teachers and students. By now, the United States has made great progress in the full implementation of education empowerment and its application, and IT-enabled education has a reliable support point. Under the influence of the subprime mortgage crisis in 2007 and the financial crisis in 2008, the U.S. education sector was greatly affected, and the investment in education was drastically reduced and the quality of education began to decline. Faced with such a situation, the Obama administration released "The American Recovery and Reinvestment Act," in 2009, aiming to increase the importance of education information technology infrastructure. This is the largest spending bill of the U.S. government since the Second World War [7] It proposed to provide funding for states to establish education information technology infrastructure, and hoped that the increased investment in the education sector could stimulate the development of downstream industries and contribute to economic recovery.

During this period, the United States completed 100 percent coverage of computer facilities in

schools nationwide, 97 percent of public schools were equipped with projection equipment, 69 percent of schools were equipped with wireless networks, and 72 percent of schools were equipped with relevant educational information technology for online assessment of student learning outcomes.[8] The federal government is working to strengthen hardware and software in conjunction with The federal government is gradually taking into account the promotion and use of digital teaching resources while strengthening hardware and software construction and financial support. Through the continuous improvement of education information technology, the gap between regions in education is gradually reduced and the quality of basic education personnel is continuously improved.

2.3. 2010 to present: deepening innovation stage

Against the backdrop of the rapid development and popularity of emerging technologies, the construction of information technology for education in the United States was also brought to a new strategic level in order to respond to the core issue of high-quality development for every student and to continue to improve the level of information technology-enabled education. In order to use the power of information technology to change the problem of declining quality of education and rising high school dropout rate in the United States, and to create an environment for lifelong learning of students.

In 2010, the U.S. Department of Education issued NETP2010, "Transforming American Education: Technology-Driven Learning," which proposed exploring personalized teaching models and improving the quality of information-based teaching.[9] In 2011, the U.S. Department of Education released the report "International Experiences with Technology in Education", which focused on the development experiences of countries and regions in the world that were more advanced in education informatization at the time, and focused on learning from related experiences while increasing investment in education. In 2012, the Obama administration released a program called "Big Data Research and Development" to explore the effective use of big data in education, improve the education and research environment in U.S. schools at that time through big data, reduce the disparity in education development between regions, and continuously The program explored the effective use of big data in education, improving the educational and research environment in U.S. schools at the time through big data, reducing the disparity in educational development between regions, and continuously expanding the connotation of IT-enabled education. In 2013, the U.S. government released "The Connect ED" for Education Initiative, which proposes to make full use of available funding to help schools and libraries introduce high-speed information networks. In 2015, the U.S. released the "Every Student Succeeds Act," which states that U.S. states and school districts should increase funding dedicated to education information technology and accelerate the transformation of teaching methods, and the impact of information technology on education was further expanded. In the same year, the Obama administration launched a new open e-book project, which aims to help build world-class digital libraries for children from poor families who are receiving primary education. In 2016, the U.S. Department of Education issued NETP 2016, "Future Ready learning: Reimagining the Role of Technology in Education," which proposes to value the transformation of teacher-student relationships in the context of technology-based teaching and learning. Technology to promote educational equity. Schools, families, and communities should focus on coordinating and collaborating to ensure the connectivity of home networks, improve students' capacity for IT-based lifelong learning, and protect student privacy. 2017 saw the re-release of NETP2017, a supplement to NETP2106, "Reimagining the Role of Technology in Education," which refines the framework for learning, teaching, assessment, leadership, and infrastructure. Further clarification is provided. Focus on opening up multiple

channels to promote effective student learning, promote informal learning, online learning, project-based learning, distance learning, and other personalized learning methods, and strive to achieve quality and equitable education in the vision of information-based education [10]. As of 2017, the U.S. Department of Education has promulgated six national education technology plans, NETP1996, NETP2000, NETP2004, NETP2010, NETP2016 and NETP2017, which have greatly advanced the process of informatization of education in the U.S. However, schools in remote and poor areas in the U.S. are still not well equipped to ride on the "ship of the information technology-enabled education". However, schools in remote and poor areas in the United States are still not well positioned to ride the "information age ship" of IT-enabled education. The emphasis on using information technology to narrow regional development differences and promote students' individual development has become a deep-seated part of the policy. In the midst of the AI boom, the U.S. government launched the "American AI Initiative" program in 2019, affirming the important role of information technology in talent development and education quality improvement. Under the impact of the global New Crown epidemic, the U.S. Congress passed the "American Rescue Plan" in 2021, which aims to meet the diversified and individualized needs of students for education under the impact of the New Crown epidemic and strengthen the popularity of online education. In April 2022, the U.S. Department of Education released the "2022 Agency Equity Plan", which emphasizes the use of information technology in education to promote racial equity, reduce regional disparities, and make education a "social equalizer.[11] In April 2022, the U.S. Department of Education released the Government Equity Plan 2022, which emphasizes the use of information technology in education to promote equality between races, reduce regional disparities and make education a "social equalizer.

During this period, the U.S. designed the development path of education informatization at the top level by formulating continuous and progressive policies. With the goal of achieving the cultivation of students' good information technology skills, it has strongly promoted all students across the U.S. to join the tide of the era of education informatization. And by further deepening innovative information technology to fully empower the field of education, we have made every effort to promote a significant increase in teaching efficiency, making the United States one of the most advanced countries in education informatization.

3. Practical characteristics of information technology-enabled education in the United States

3.1. Continuously increase financial investment to strengthen the construction of education information technology infrastructure

The construction of education information technology infrastructure is an essential support in the process of education modernization. One of the big factors for such a high achievement of education informatization in the United States at present is the perfect infrastructure and the fact that rural and urban areas are developed simultaneously. Education informatization infrastructure is the basic premise to ensure the comprehensive use of education technology, improve the concept, methods and means of education teaching, and ultimately realize the material basis and main conditions of education informatization strategy. [12]

Because of the local decentralization system adopted in the United States, policies and standards have been developed from the federal government to the state governments to the communities and schools. The U.S. has embarked on a nationwide movement to transform learning by advocating and establishing a basic structure for educational information technology, which has laid a solid foundation for the development of educational information technology.[13] For example, the federal Department of Education has established a dedicated Office of Educational Technology and continues to develop new NETPs in light of actual developments in the U.S. Policies and NETPs

issued at various stages of development emphasize the enhanced use of information technology in teaching and learning, especially in light of the economic crisis and the new crown epidemic, and investment in educational information technology has increased rather than decreased. Multiple measures have been taken to work to ensure that all students across the United States have access to quality education. We have achieved: (1) 99% of students across the U.S. have access to high-speed Internet service [14] (2) government and non-profit organizations are committed to supporting and funding Internet services in schools and libraries; (3) organizations such as Access for All are committed to funding Internet access for low-income families and have achieved good results; (4) schools and IT developers are working to protect students' privacy; and (5) quality education is provided. privacy; (5) the provision of high-quality, no-cost, open, and optimal access to online learning content and resources; and (6) the legal requirement to provide all elementary and secondary school students with free, powerful digital school equipment and other high-quality educational information technology infrastructure.

3.2. Emphasis on strengthening teacher training and improving teachers' IT application level

The United States attaches great importance to updating and improving teachers' IT knowledge and skills in a timely manner, and has included educational technology proficiency as an important indicator of teacher quality in elementary and secondary schools. The high standard of teachers is one of the main reasons for the rapid development of education in the U.S. Enhancing teachers' professional development has been a very important issue. Through the continuous enactment of various laws and regulations, teachers' IT literacy is effectively cultivated and the level of IT application is enhanced.

Under the influence of the National Commission on the Future of the United States, which considers standardization to be an important marker of the teaching profession, the main measure of information technology teaching reform for teachers in the United States is the establishment of information technology standards. The International Society for Technology in Education united various influential educational organizations in 2000 to develop the U.S. National Standards for Educational Technology, which systematically describe the basic concepts, knowledge and skills for using information technology in teaching. They are reflected in the U.S. Education Goals Act of 2000, Connecting Teachers to Technology, the Act to Meaningfully Promote Excellence in Technology, Education, and Science, and other bills and educational technology initiatives. Distance training through the use of online technology is also a major feature of teacher preparation in the United States. Teachers can use the continuous development of the Internet to update their educational concepts and methods, learn in-depth professional knowledge through training, and keep pace with the development of the times, as well as improve their own abilities in all aspects. For example, Yale University provides free training in information technology for local elementary and middle school teachers, and gives certain subsidies to teachers who participate in the training. For example, Connecticut's Distance Learning Steering Committee has partnered with 42 colleges and universities and 12 elementary and middle schools to build an extremely rich set of distance learning online training resources, which has been well received.[15]

3.3. Promoting the application of educational software to promote changes in teaching methods in the information age

From the historical path of information technology-enabled education in the United States, information technology has effectively contributed to the reform of teaching methods. With the development and maturation of the Internet and other high technologies in the field of education, the model, method and realization path of curriculum and teaching in American education have

been transformed with the development of the information technology era. This is reflected in subject teaching, education management and evaluation, communication and exchange between home and school, and lifelong education.

First, in subject education and teaching, the latest information technology research results are applied in the classroom on the front line. In terms of hardware, it ranges from basic computer supporting equipment and multimedia projectors to interactive whiteboards, intelligent multimedia and now artificial intelligence education supporting equipment. In terms of software, there are many Internet companies in the United States that are dedicated to developing educational applications, but the front-line applications still do not perfectly meet the diverse needs of students, so teachers are processing and transforming the existing educational software. Second, in the management and evaluation of education, the U.S. federal government and the Department of Education manage the educational management and teaching evaluation of each state or school district by building an educational resource management platform. For example, information on the degree of computer equipment in schools within a school district, the implementation of IT curriculum, school-district interaction, wireless network ratios and technical support received can be quickly found, and the government and the Ministry of Education can quickly grasp the basic situation of education information technology development in each school and inter-school differences. Third, in terms of communication between schools and students' families, the U.S. has traditionally attached importance to the interaction between schools and students' families. In the U.S., more and more schools are posting lesson plans, syllabi, and course handouts for different subjects on the school curriculum website so that parents can easily learn about the school's teaching situation at any time. Some school districts and colleges have also set up special programs to promote the connection between schools and families and communities. Fourth, in terms of lifelong education, U.S. education information technology is committed to providing lifelong learning mechanisms for all students in the knowledge economy era. In recent years, with the rapid development of education technology, the expanding education market has attracted many educational institutions to actively participate in education competition, emphasizing the use of new technologies and methods to adapt to the diverse learning needs of learners and promote the construction of a lifelong learning system. [16]

3.4. Strong regulation of national policies, strong to bridge the digital divide between regions

In the special plan of education informatization, the U.S. government has proposed the "Information Superhighway" plan, "second-generation information network construction" and "E-Rate" projects, which have laid a good foundation for the application of big data in U.S. education. This has laid a good foundation for the application of big data in U.S. education. To promote digital learning and bridge the digital divide between districts, the U.S. government has developed different versions of the NETP to establish a digital assessment system, improve teachers' IT skills, and put the use of education technology into practice.

The E-rate program implemented in the United States to ensure that schools and libraries across the country have access to high-quality Internet broadband has played a critical role in bridging the digital divide between elementary and secondary schools in different parts of the country. For one, the U.S. government has increased funding for schools and libraries, thus ensuring that future gigabit broadband networks will be available to students. In addition, schools and libraries have greater flexibility in acquiring broadband services to meet the demand for Internet capacity at the lowest possible cost. Second, in the most cost-effective part, schools and libraries in a position to do so can build their own Internet broadband facilities and benefit from a range of government safeguards for them. The state provides financial support for the construction of last-mile broadband

facilities, and schools in some lagging regions can enjoy subsidies of up to 10 percent of construction costs through the E-rate program. Schools and libraries that receive subsidies from the Rural Public Service Program are not allowed to reduce their broadband speeds by IT developers and operators and must provide them with broadband speeds comparable to those that do not participate in the discount. Third, the federal government offers educational discounts ranging from 20-90% to schools and libraries, with even greater discounts for poorer areas. This has allowed schools in poor and rural areas to gain more benefits and change the educational information technology situation in the backward areas.

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