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Education Equity and Technology Divide in the United States

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Abstract

This article discusses the perspective that development involves expanding human capacities, with knowledge being a crucial capacity. Information and Communication Technologies (ICTs) play a vital role in producing and disseminating knowledge, and their use is considered a right in today's society. However, not all Americans have equal access to these technologies. Marginalized communities, often lacking resources for basic needs like clean water, food, and education, face significant challenges in adopting ICTs. This digital divide results in educational and economic inequalities.

The study employs the Technology Acceptance Model (TAM) to explore the technology gap in education between upper-class and marginalized communities in the United States. It seeks to understand the factors contributing to this divide by reviewing relevant literature, surveys and interviews The research aims to answer the question of how to narrow the digital divide and promote equal access to educational technology. Potential solutions are also discussed.

Keywords: Digital divide; ICT; Less Privileged; Digital equity

1. Introduction

From the perspective of the school of thought that maintains that development mainly consists of the progressive expansion of human capacities (Sen, 2000), knowledge is one of the main human capacities, while ICTs are privileged means through which knowledge is produced and disseminated. Nowadays, ICTs are associated with essential aspects of human life, and as such, their use may be deemed to be a right (Accuosto, Cortés & Dubois, 2004)

Although Americans are aware of the potential and importance of the digital revolution, not all of them have access to communications technologies.

Being involved in this technology revolution is capital intensive and requires substantial capital. Unfortunately, those communities that are in the most desperate need of basic information technology and telecommunications infrastructure can rarely afford ICT systems nor do these communities possess the technological know-how needed to operate the new technologies. Even worse, many of these communities are struggling just to meet their basic needs, such as clean drinking water, food, shelter, electricity, schools, and basic health care. As a result, many people are forced to miss out on the opportunities created by the digital revolution thereby leading to the technology divide between the wealthier and marginalised communities. On the one hand, access to these technologies represents educational progress for the wealthier communities but on the other, lack of educational development for the underprivileged communities which results in an inequality known as the “digital divide”.

The less privileged communities in America are often faced with challenges in education and as a result long-term economic stability due to a deficiency in access to digital resources, and minimal opportunities for advanced education. This study applies the Technology Acceptance Model (TAM) to explore the technological divide in education between

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the wealthier and the less privileged communities in the U.S. To successfully bridge the technology divide in education in the U.S. is predicated on the adoption and usage of technology by marginalized communities. The contribution of this research is to enhance our understanding of the factors associated with the divide through the use of literature reviews of studies, articles, and surveys. Potential solutions are discussed, including increased attention from educational institutions, fostering family engagement and support, funding and grants, and technology access and support.

This study will be answering the research question what effective strategies can be devised to narrow the digital divide and promote equal access to educational technology? Proffering innovative solutions that can be developed to address the digital disparities in education between the upper class and the marginalized communities.

1.1. History of Technology and Education in America

As explored by academics, the history of technology's role in education is a complex and continuously evolving narrative that spans many centuries. Scholars have examined various pivotal moments and shifts in educational technology to gain insight into how it has influenced the processes of teaching and learning. (Kliebard, 1987).

In 1932, during a period of economic downturn, the National Academy of Visual Instruction (NAVI) merged with the Department of Visual Instruction (DVI) under the umbrella of the National Education Association (NEA) (Kliebard, 1987). This merger surprised those involved in the ongoing debate over educational reform, as it represented a unique blend of local school reform efforts. In the early 20th century, there had been a vigorous contest for dominance in shaping the U.S. curriculum, which had intensified during the mid-1920s, leading to a highly contentious educational landscape (Kliebard, 1987).

Education rapidly spread among the free citizens of the United States during the nineteenth century, and by the 1840s, according to some estimates, the per capita enrolment in primary schools in the United States had surpassed that of Germany. By this measure, Americans had become the well-educated population among the wealthier nations of the world (Easterlin, 1981).

The United States proudly claims remarkably high literacy rates, especially among its free population. While the U.S. drew inspiration from European educational concepts and institutions, it adeptly adapted them to align with uniquely American approaches. (Easterlin, 1981).

American educational institutions, spanning various levels, tended to emphasize practical and applied learning, setting them apart from their European counterparts. (Easterlin, 1981).

With the introduction of publicly funded elementary schools, girls received education for a duration similar to that of boys. Furthermore, during the early to mid-twentieth century, a greater percentage of girls, in comparison to boys, took part in secondary education and successfully completed their studies. (Fishlow, 1966).

However, when it comes to presenting school enrollment, attendance, and literacy rates for the early to mid-nineteenth century, the available data remains incomplete and susceptible to numerous potential biases (Fishlow, 1966). These statistics were omitted from the previous edition of Historical Statistics of the United States, and despite extensive research in the past twenty-five years, the data still requires refinement. Part of the challenge stems from the geographical gaps in the data (Fishlow, 1966).

In a relatively short span of just half a century, the United States achieved the distinction of becoming the best-educated country in the world. (Saettler, 1990). Prior to the mid-nineteenth century, elementary education was predominantly provided in "common schools" that were publicly operated but often not fully publicly funded. In certain districts, parents were billed a "rate bill" for their children's education. In other regions, a portion of the term was publicly funded, while the rate bill supported an extended term. In major cities like New York City, there were public-funded pauper schools alongside private schools catering to more privileged students (Saettler, 1990).

Despite encountering several challenges in the compilation of educational data series, the task has been somewhat facilitated by the relative stability and consistency of educational institutions in the United States. (Goldin & Katz, 1999b). Educational levels in the U.S. have maintained a degree of uniformity over time and across different geographical regions. (Goldin & Katz, 1999b). Typically, the term "common school" encompassed young individuals aged between 6 or 7 and sometimes as old as 14 or 15 years, depending on their attendance patterns. The concept of a "common school" generally covered grades from the first to the eighth, although these schools were often informally structured, operated within a single room, and had a single teacher. (Goldin & Katz, 1999b). These common schools

were primarily located in rural or open country areas and remained prevalent until the mid-twentieth century. In rural regions, it was not uncommon for young individuals to attend common school for more than eight years, although this extended attendance typically served as a form of remedial education rather than signifying secondary school-level instruction (Goldin & Katz, 1999b). In contrast, towns, villages, and cities typically featured graded elementary schools.

Each state, both in the present day and historically, establishes its criteria for promotion and graduation. With the establishment of state universities, high school graduation often implied automatic admission to college. (Bishop, 1989). Consequently, states took a keen interest in setting proficiency standards for high school graduation. Similarly, promotion from the eighth grade in many states served as admission to public high schools, and many states also monitored this transition. In the early twentieth century, especially after World War I, various states took the lead in student testing (Bishop, 1989). A version of the well-known Iowa Test of Educational Development began in the 1920s but wasn't administered statewide for another decade. Additionally, the New York and California Regents developed their own examinations. However, there is limited available evidence regarding time trends in elementary and secondary school exam scores (Bishop, 1989).

The term "technology" finds its roots in the ancient Greek word "techne," which can be translated as art, craft, or skill. In the realm of ancient Greek philosophy, it was initially conceived as a distinct activity and a form of knowledge. (Saettler, 1990)It held a dual nature, being referred to as both "techne" and "episteme," the latter representing systematic or scientific knowledge. According to Aristotle, "techne" denoted the methodical application of knowledge for intelligent human actions (Saettler, 1990). Aristotle further elaborated on this notion by proposing that educational technology involves the use of machines to facilitate instruction.

The examination of technology's role within educational contexts has gained prominence in educational research. The integration of technology into education is not a recent phenomenon, and the continuous advancement of technological tools has brought about significant transformations in the teaching process. Additionally, technology is increasingly recognized as a valuable tool for enhancing the learning experience. (Easterlin 1981).

The realm of Technology education, also known as Machine-mediated instruction, has been more of a process than a static product, considering the ongoing innovation in the field of technology.

Educational Technology, despite the uncertainty surrounding the term's origin, can be traced back to the time when tribal priests organized bodies of knowledge, and early cultures devised pictographs or sign writing to record and transmit information. The level of advancement in culture is often correlated with the complexity of the instructional technology created to reflect specific modes of thinking, acting, speaking, or feeling (Easterlin 1981).

Over the centuries, significant shifts in educational values, goals, or objectives have given rise to various instructional technologies. Similarly, the invention of the printing press marked a pivotal development in the history of disseminating instruction, which was especially crucial for cultures with complex and advanced technologies. Prior to this innovation, books were painstakingly created by hand or through the use of woodblocks. (Heinich et al.)

In the seventeenth century, Johann Comenius, a Moravian teacher and theologian, recognized the potential of printed books to arrange subject matter in an optimal sequence, enabling the simultaneous education of several hundred students (Heinich et al.)Comenius is regarded as a precursor to modern programmed instruction.

It is evident that educational technology is fundamentally the outcome of a rich historical lineage, characterized by trial and error, extensive practice, imitation, and sporadic displays of extraordinary individual creativity. Educational technology has consistently supported the application of knowledge to the practical task of teaching and learning (Heinich et al.).

Technological innovations have introduced new Learning Management Systems (LMSs), acquainting educators with technology-mediated education, including the utilization of pedagogical approaches and other technologies to facilitate or foster learning (Dron, 2022)

2. Literature Review

The contemporary era is often referred to as the information age, where Information and Communication Technologies (ICTs) are considered a primary means of production (Rogers, 2016). The socioeconomic development of countries now heavily relies on their access to and generation of information.

When examining traditional educational disparities in the United States—such as the rural-urban divide, gender discrepancies, and disparities between white Americans and African Americans, Latinos, Indigenous, or other minority groups—one may ponder whether the digital divide represents a modern form of discrimination. Discrimination based on factors like race, ethnicity, socioeconomic status, and gender has persisted in U.S. schools since the colonial period (Spring, 2000).

Despite the belief since the era of common schooling that education would alleviate issues of unequal property distribution by boosting societal wealth and subsequently improving the economic conditions of the underprivileged, one must question why the divide still persists and what efforts have been made to bridge it.

Over the past two decades, the role of computers in American schools has expanded significantly, evolving into an essential learning tool integrated into daily classroom life (Puma, Chaplin & Page, 2000). Specifically, the Internet has exposed students to subjects they previously encountered only in textbooks or libraries, empowered teachers to enhance their classroom teaching, and created more opportunities for teacher professional development (Puma, Chaplin & Page, 2000). The significance of the Internet is particularly notable for rural and less privileged communities in the United States, as it offers them the opportunity to learn beyond the confines of traditional classrooms. Educators can also engage with their peers both within the country and globally through the Internet. (Puma, Chaplin & Page, 2000) With just a click, these students can access information that would have previously required extensive library research or remained entirely inaccessible in their school or local library.

However, providing public schools with access to technology at the classroom level, where it can be integrated into daily instruction, has proven to be a considerable challenge, especially for marginalized communities that make up a significant portion of these schools. (Mack, 2001).

As expected, the percentage of classrooms equipped with technology varies along wealth lines, with 74 percent of the wealthiest schools likely to have such access, while only 39 percent of the poorest schools possess similar capabilities (Mack, 2001).

The initial studies on the digital divide emerged in the 1990s and primarily focused on issues related to access to digital technologies and the Internet. Within the field of the digital divide in education, scholars have identified three distinct levels (Swapnil et al., 2022). According to contemporary research, the first level involves disparities in physical access to the internet and digital devices; the second level pertains to differences in digital skills and motivation to use technology (referred to as the "use gap"); and the third level encompasses variations in the benefits derived from technology usage (Swapnil et al., 2022).

Numerous studies have consistently demonstrated that wealth plays a pivotal role in shaping opportunities for ICT (Information and Communication Technology) access. These investigations have established a direct correlation between income and access to technology, positing that higher income levels enhance individuals' capacity to utilize ICT, while lower income levels limit opportunities (Swapnil et al., 2022). Consequently, the term "digital divide" denotes unequal access to information technology (Cronin, 2002).

The phenomenon of the digital divide is not a recent development. In the late 1980s and early 1990s, discussions centered on the division between the information-rich and information-poor. Subsequently, the advent of the public Internet made the information gap between the "haves" and "have-nots" more visible (Cronin, 2002). Tangible differences in computer ownership, access to information technology, and basic indicators of internet connectivity starkly highlighted the disparities between privileged and marginalized groups within U.S. society (Cronin, 2002).

It is a well-established fact that economically disadvantaged communities in the United States have limited access to digital devices. Consequently, students from these communities often face a digital gap and require access to ICT for educational purposes (Cronin, 2002).

Understanding the digital divide in education necessitates an examination of the underlying forces that influence it. The digital divide is shaped by five broad categories of forces: societal, technological, economic, political, and environmental (Mitchell, 2001). Therefore, many believe that the digital divide can be explained by factors such as income, education, and location, or as "the line that separates those who have access to computers, possess the requisite skills, and use the Internet from those who lack access to computer technology and the Internet" (Gaillard, 2001).

This goes a long way to emphasize that access to computers and the Internet, and the facility to effectively use this technology, are becoming increasingly important for full participation in education and the marginalized communities require access to participate fully in the technology-enhanced learning era.

2.1. Theoretical Framework

The Technology Acceptance Model (TAM) is a widely recognized theory in the field of information systems and technology adoption. It was originally developed by Fred Davis in the late 1980s and has since been extended and refined by various researchers. TAM seeks to explain and predict how users accept and use technology. (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005)

Several theoretical models have been developed and applied to study the acceptance and usage behavior of information technologies, but among the various theories, the Technology Acceptance Model (TAM) is considered one of the most influential and most widely used by researchers to describe the acceptance of any technology by individuals and group of people studying the influence of human factors and other factors in the adoption of new technologies (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005).

The core components of the Technology Acceptance Model are perceived usefulness and Perceived Ease of Use. Perceived Usefulness pertains to the user's belief or perception that employing a specific technology will enhance their job performance, augment productivity, or provide other tangible advantages. Users are more inclined to accept and employ technology when they perceive it as beneficial (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005). This theory was useful in determining how and if the marginalized communities perceive technology to be beneficial in their educational lives to ascertain the factors to consider to bridge the divide. ("*Technology Acceptance Model"*) On the other hand, Perceived Ease of Use was also used to determine user's perception of how easy or difficult it is to use technology in education. This was important for this study in order to know the programs to introduce to these communities to facilitate ease and the acceptance of the use of technology thereby bridging the divide. A technology that is perceived as easy to use is more likely to be accepted and adopted. (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005).

These factors of TAM directly influence a user's intention to use a technology, which in turn predicts their actual usage behavior. Additionally, external factors, such as social-economic influence and facilitating conditions, can also influence their intention and actual use of technology in education (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005).

TAM has found extensive application in both research and real-world scenarios for evaluating and forecasting the reception and integration of a wide array of information technologies, software applications, and digital services across a multitude of platforms (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005). It offers valuable insights to government bodies and organizations when it comes to the planning, execution, or introduction of technologies to users spanning various sectors such as education, agriculture, and more. (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005).

In the same vein, TAM recognizes the importance of facilitating conditions for technology use. Bridging the divide often involves addressing infrastructure and access challenges in less privileged areas. By improving the physical infrastructure and providing necessary resources, governments and organizations can create an environment conducive to technology adoption.

Through Customizing Interventions: TAM can be used to tailor technology interventions for specific socioeconomic groups. Understanding the unique needs and preferences of these under privileged communities can help in designing solutions that are more inclusive and effective in narrowing the digital divide. (Dillon & Morris, 1996; Lee, Kozar & Larsen, 2003; Silva, 2005).

3. Methodology

Qualitative Method Interviews were used to analyze the impacts of the digital divide on students from upper-class families and traditionally marginalized families, as well as public and private schools with a view to studying and ascertaining the level of digital divide between the poor communities and the rich. Qualitative methodology allows for the adoption of a useful holistic perspective in the study of a complex phenomenon (Taylor & Bogdan, 1986) Thus, the analysis was enriched with explanatory elements, and through the use of interviews, it was possible to reformulate the data-gathering tool which was basically questionnaires.

Data was gathered at the community level, with a focus on marginalized groups such as African Americans, Hispanics, and Native Americans. The questions centered around their access to technology for learning in schools, as well as their access to ICT devices and internet connectivity in their homes. This approach aimed to ascertain who was acquainted with technology usage and who was not.

Additionally, some questions were directed toward school administrators in both high-income schools attended by affluent communities and public schools predominantly serving the non-wealthy communities. The purpose was to gather information regarding the availability and accessibility of technology to students in both expensive, well-funded schools and public schools in marginalized communities.

Surveys were also administered to parents in various households within the context of this study to assess their level of technological proficiency and their ability to provide relevant devices to support their children's learning, given the evolving technological landscape.

4. Results and discussion

4.1. Socioeconomic Characteristics

Low-income families find it very challenging to acquire or upgrade ICT devices and cover the costs of internet access this leads to a sense of exclusion from the digital world. Conversely, high-income families typically have access to the latest and most advanced ICT devices, including powerful computers, tablets, and smartphones. This access allows them to leverage cutting-edge tools and software for various purposes, including education and productivity.

The survey targeted both economically disadvantaged communities and affluent ones. It revealed that families with lower incomes encountered difficulties in acquiring or upgrading ICT devices and affording internet access, resulting in feelings of exclusion. Conversely, affluent families had access to a variety of ICT devices and could afford any necessary internet services.

4.2. Educational Characteristics

The educational divide in low-income families results in limited access to digital learning resources and educational technology compared to their wealthier counterparts. This discrepancy can lead to educational inequalities and impede academic progress. The survey findings indicated that individuals from low-income families had restricted access to digital learning opportunities and exhibited lower technological proficiency, whereas households in affluent communities demonstrated greater proficiency in technology-related learning and ICT skills. The school directors' responses highlighted the insufficient availability of ICT systems in their classrooms and the lack of interest of some students in ICT

4.3. General Attitudes toward ICT

Among many low-income parents and caregivers, there is a recognition of the significance of ICT in education, particularly in the context of the digitalization of learning during and after the COVID-19 pandemic. They express concerns about the potential academic setbacks their children experienced and may face due to limited access to technology resources. Additionally, some individuals from low-income backgrounds express a desire to enhance their digital literacy skills, acknowledging the growing importance of such skills in education and daily life. They are also seeking opportunities for training and support in this area.

In contrast, wealthier families demonstrated a more thorough understanding of technology and its relevance to education, given their regular utilization of ICT facilities in their daily lives.

Recommendations

To contribute to human development, policies should prioritize the processes of ICT adoption, align with community needs, and place a strong emphasis on building people's capabilities, content generation, and knowledge (Gómez, Delgadillo, & Stoll, 2003; Mística, 2002). Without specific policies addressing technology access, human development will remain an unattainable goal, and the existing divide will only continue to widen.

Addressing this digital divide necessitates targeted policies and initiatives designed to bridge the gap and foster digital inclusion within marginalized communities. To this end, potential solutions for bridging the divide are outlined below:

Survey and Provision of ICT Systems in Schools: Considering one of the study's findings is the insufficient supply of ICT systems to accommodate all students, it is imperative to increase the provision of ICT (Information and Communication Technology) systems in schools. This step is crucial for narrowing the digital divide and ensuring equitable access to technology for students. Prior to supplying ICT systems, it is essential to conduct a thorough assessment of each school's specific needs, including determining the quantity and type of devices required (e.g., laptops, tablets, etc.), as well as assessing the necessary software and infrastructure. Based on the survey results, the government can extend support to schools, especially those serving traditionally marginalized student populations. Developing a technology plan that ensures every student has the opportunity to gain computer literacy will further support this endeavor.

Additionally, governments should allocate budgets for the purchase and maintenance of ICT systems in schools. This budget should cover not only the initial procurement but also ongoing expenses such as maintenance, software licenses, and technical support.

4.4. Involvement of Teachers and Schools

Addressing the complexity of bridging the technology divide requires the active participation of schools, with government support. To begin, the government should ensure that all school staff members become proficient computer users. Achieving this can be accomplished through professional development and training programs designed to empower teachers in effectively integrating ICT into their teaching methods. Teachers should feel confident in utilizing technology for instruction and assisting students with digital learning.

Academic Directors should take proactive measures to ensure that all students have equal access to technology resources and possess the skills to use them effectively. They should also foster a culture of equity among the staff, encouraging them to be vigilant and vocal when they observe disparities in technology access or utilization. For example, staff members can conduct assessments of computer availability within the school and monitor usage patterns. They can also track whether all students have opportunities to engage in "virtual" field trips or participate in collaborative projects facilitated by networking.

To engage parents in these initiatives, schools can organize computer lab nights where students and parents collaborate on computer-based activities. In consideration of parents' work schedules, schools may need to provide childcare during these sessions. Additionally, activities can be scheduled during the day for parents who are available during those hours, have other children to care for in the evening, or prefer daytime participation. If schools lack sufficient equipment, they can explore options for borrowing equipment and instructional software for a specified period. This might include computers, educational videos, and handheld calculators. Labs can be kept open before and after school, in the evenings, and during the summer (in coordination with summer school programs), with the support of volunteers to staff and supervise these extended hours

4.5. Awareness campaign

Awareness campaigns are instrumental in bridging the digital divide because they play a vital role in educating, mobilizing, and engaging individuals, communities, and policymakers in efforts to address digital inequities

These campaigns will inform individuals, particularly those in marginalized or underserved communities, about the benefits of digital inclusion. They educate people on how access to technology can improve education, employment opportunities, healthcare access, and overall quality of life.

It will further empower them by providing information on how to access technology resources and develop digital literacy skills. They help people take steps toward bridging the divide by guiding them on where to find affordable devices, low-cost internet options, and digital skills training.

4.6. Collaboration with Community Partners

Schools can collaborate with local businesses, non-profits, and government agencies to secure resources and support for bridging the technology divide. Partnerships can lead to initiatives like technology donations, subsidized internet access, and community tech training programs, etc. Community partners can provide resources such as computers, tablets, Wi-Fi hotspots, and software licenses, which can be distributed to these marginalized families. This will reduce the financial barriers to accessing technology.

This partnership can establish help centers staffed by volunteers or experts who can assist individuals with technical issues, troubleshooting, and general tech-related inquiries.

5. Conclusion

The use of ICT in learning is now a necessity, the Government of the United States has to widen the opportunities and participation to rural Americans as they are often faced with challenges in education, long-term economic issues leading to deficiency in access to digital resources, and minimal opportunities for advanced education. This article has explored these deficiencies and, potential solutions have been discussed to mitigate the problem of illiteracy and education digital divide in the disadvantaged communities of the country.

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