Is digital technology the key to American education in the twenty-first century?

Lauren Morgan

Candidate #6130

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Introduction

Over the course of the past year, the COVID-19 pandemic has stimulated a global shift towards a virtual world. This dramatic integration of technology into daily life has impacted almost every walk of life, including the education system. This sudden transition has challenged me, along with 1.5 billion students around the world, to adapt to online learning (Strauss, 2020). While the role of digital technology has evolved rapidly since the onset of the 'digital age' in the 70's, I have never reflected upon these fast-paced advancements because I have grown up immersed in them (Jerald, 2009). My own experience during the pandemic has evoked curiosity about factors contributing to a successful education. Before thorough investigation, I stepped into this argument believing that digital technology is necessary in the modern education experience. Outside of the classroom, technology has allowed me to fill the gaps of what I am unable to comprehend inside the classroom, through supplementary audio, visual, and interactive resources. Nevertheless, when I think about the brilliants minds of those who came before me, I recognize that most of them did not grow up in the digital age. Therefore, I was eager to delve deep into the core of what it means to be educated in the twenty-first century, how digital technology plays into this, and whether it is a necessity within the American education system. As society progresses towards a 'new normal' of education, I believe this debate has never been more important to address.

To investigate this complex question, I decided to divide my paper into two main arguments from the perspectives of 'providers' and 'beneficiaries'. Providers refer to the educational institutions, administrators, and instructors who provide information and digital technology to students. Beneficiaries, represented by the students, receive and utilize these digital technologies. After debating whether to structure this discourse into primary, secondary, and post-secondary

education, I am glad I chose the current methodology because I was able to deeply explore these two viewpoints. Nevertheless, it is important to clarify that 'American education' is confined to kindergarten through college within this paper. When assessing my research methodology, I have discovered that despite the challenges of pursuing such wide lenses, this method ultimately enabled me to explore the humanistic arguments of this debate, strengthened with quantitative evidence as well.

Before moving on, it is essential to clarify a few key terms which are prevalent throughout the research report. For the purpose of this research report, 'digital technology' will be defined as,

> digital processing systems that encourage active learning, knowledge construction, inquiry, and exploration on the part of the learners, and which allow for remote communication as well as data sharing to take place between teachers and/or learners in different physical classroom locations (UCLES, 2017).

Examples of digital technology include, but are not limited to, computers, tablets, smartboards, and even smartphones. They allow access to a multitude of resources such as scholarly research sites, video conferencing, gradebooks, instructional videos, etc. As I dive into this paper, the role of these digital technologies, along with the access they bring, will be evaluated and debated to answer the question, *Is digital technology the key to American education in the twenty-first century?*

Providers

The advancements of digital technology have molded the American classroom. In the traditional education system, the pedagogy was "teacher-centered delivery of instruction to classes of students who are the receivers of information" (Huson, 2020). Unlike the past, in which teachers were the providers of limited, but reliable content information, digital technology has now surpassed this role by supplying boundless, though not always credible, information. For this reason, distinguished alumni scholar and graduate of Stanford university, Dr. José Antonio Bowen, argues against the reliance on technology within the classroom in his book, *Teaching Naked: How Moving Technology Out of Your College Classroom Will Improve Student Learning*. Bowen has multiple interests and responsibilities as seen through his four interdisciplinary degrees and Bowen Innovation Group LLC, where he innovates, leads, consults, and trains in higher education and a variety of Fortune 500 Companies (*Bio*, 2020). His expertise in a variety of areas, along with his previous and ongoing work within education, on both the administrative and research publication ends, proves his worth as an expert. Furthermore, he has received the Ness Award for Best Book on Higher Education, the Ernest L. Boyer award for Significant Contributions to American Higher Education, and a Stanford Centennial Award for Undergraduate Teaching in 1990 (*Bio*, 2020). These honors recognize his continued dedication to improving education, an integral factor of his credibility. Within his highly regarded book, *Teaching Naked: How Moving Technology Out of Your College Classroom Will Improve Student Learning,* Bowen addresses the modern challenges that American universities face due to digital technology:

> American universities, however, need to reexamine core beliefs… To add value and compete in the next centuries, universities will need to do much more than just deliver content: that will be done more efficiently and cheaply online. To provide the sorts of critical thinkers that employers, governments, and the public now insist on, universities need to rethink both the use of technology and the design of the liberal arts education…knowledge can open minds, but research

> demonstrates that application, integration, and personalization of content opens minds more effectively (Bowen, 2012).

In this excerpt, Bowen argues that the role of educational providers should focus less on the dissemination of knowledge for the purpose of retention and recall, but rather on the critical thinking skills needed to effectively utilize the content given. Thus, while digital technology is undoubtedly a beneficial tool for retrieving learning material, the implications of its widespread accessibility in the twenty-first century is redefining the purpose of American education systems. With unlimited public knowledge now available on the internet, it can be decided that the value of providers lies within their ability to stimulate and develop students' ability to think critically, not simply supplying them with digital technology.

In order to fully grasp whether digital technology is necessary in modern education, it is crucial to gauge the success of non-digital learning methods. Maria Montessori (1870-1952) pioneered the Montessori education system, which has proven its success with twenty thousand schools worldwide, five thousand of which are located in the United States (National Center for Montessori in the Public Sector, 2019). Although she was not originally invested in education, it was her career in medicine where she gained an interest in the educational barriers of intellectually disabled children. Following her passions, she lectured in pedagogy at the University of Rome while pursuing studies in philosophy, psychology, and education to build her foundational knowledge on child learning development (The Editors of Encyclopaedia Britannica, 2020). Although she cannot not speak upon educational technology used in the twenty-first century, her rich understanding of the learning process from a medical, philosophical, psychological, and pedagogical standpoint validates her ability to argue the fundamental necessities of education. The Montessori method, as described by Montessori herself in *The Discovery of the Child*, paints the critical role of the teacher in student learning:

> It is difficult to train theoretically such a teacher, who ought to fashion herself, who ought to learn to observe, to be calm, patient and humble, to restrain her own impulses, and who, in her delicate mission, has a task which is eminently practical…she ought to be able to choose the appropriate object, and place it before him in such a way as to make him understand it and arouse his keen interest in it… She will learn that she must not hold back minds already abnormally developed by giving to them material less than their individual powers can handle, which creates boredom; she will learn not to offer objects which are beyond the capacity of the child, thus discouraging and destroying the first childish enthusiasm (Montessori, 2004).

When examining the role of the teacher in the Montessori method, one can marvel at the intricate responsibilities that 'she' must acquire through time and experience in order to scaffold the best learning experience for each individual student, while also keeping him/her engaged. When assessing this personalized educational technique, it is imperative to note that the intimate relationship between the teacher and student cannot be replaced by technology. A recent perspective on the use of technology in Montessori education states that "Montessorians, by comparison, have a somewhat less enthusiastic opinion with technology - especially in the early years." While some embrace technology, others refuse to, "believing that children need to learn with their own eyes and hands and absolutely not while watching a screen" (Hargis, 2017). This modern reflection reinforce that while some extent of digital technology use is inevitable, the foundation of Montessori pedagogy is still rooted in hands-on learning. A calculation can be made that it has passed the test of time and is still successful in the digital age, indicating that digital technology is not, in fact, the key to twenty-first century education in America. As a former Montessorian myself, I can concur with this dynamic in the context of my own K-3 education. While digital technology was utilized sparingly, the basis of acquiring a solid intellectual foundation existed through close and frequent interactions with teachers, who guided my independent exploration of concepts through manipulation of representative objects.

Conversely, the International Society for Technology in Education (ISTE) advocates for digital technology within the academic setting. They envision that "all educators are empowered to

harness technology to accelerate innovation in teaching and learning and inspire learners to reach their greatest potential" (ISTE, 2020). This mission captures the essence of the following experts, Jason Ravitz and Marc Prensky, both of whom have presented at ISTE conferences.

Ravitz, the founder of Evaluation by Design, dedicates his career to researching and evaluating strategies for impactful use of technology in educational programs. Prior to earning his Ph.D. in Instructional Design, Development and Evaluation, Ravitz was a teacher himself (Evaluation by Design, 2021). Though most of his current work deals solely with quantitative data, Dr. Ravitz' depth of experience in and out of the classroom as a high-reaching student, teacher, researcher, and evaluator makes him a critical voice in assessing this question.

To expand upon his 2012 research on twenty-first century student learning practices, Ravitz set out to develop an 'Impactful Technology Use' (ITU) rubric for educators to analyze the effectiveness of using technology to develop students' twenty-first century skills (communication, collaboration, selection of relevant technology tools, agency, critical thinking skills, and creativity/innovation). This study, *Assessing Classroom Technology Use for 21st Century Skills: A Research-Based Rubric*, aimed to assess how competent teachers were in interweaving technology to engage students and make a positive impact (Ravitz et al, 2020). To truly evaluate these goals and establish a meaningful ITU rubric, Ravitz and his team launched the Dynamic Learning Project (DLP) in 2017 and 2018. This eight-week coaching program was administered in a total of one hundred elementary, middle, and high schools across seven states. Around two thousand teachers, principals, and ITU coaches were engaged in the development and validation of this rubric, gaining insight on how to incorporate technology in purposeful ways. With such a significant data sample, Ravitz designed the ITU rubric through aggregate evaluation of 'Impactful Technology Use to Develop Students' 21st Century Skills' between DLP

and non-DLP trained teachers. The data, collected through a series of survey questions, indicated that 78% of DLP teachers felt confident in their abilities to use technology to develop students' 21st century skills mentioned above. This is 11% higher than that of non-DLP teachers, who indicated 67% competency (Ravitz et al, 2020). When interpreting these results, it is apparent that the majority of all teachers feel digital technology plays a major role in developing 21st century skills. However, the 11% disparity indicates that proper training is essential in maximizing the impact of these digital tools. This statistic emphasizes that digital technology, in and of itself, is not the answer. With professional coaching and ITU self-assessment, teachers would likely establish a better relationship with technology. Therefore, it can be decided that providers stand on the affirmative side of this question, that digital technology is necessary.

In addition to impactful technology use, this next author stresses the importance of evolving both the content and pedagogy of the twenty-first century curriculum to step in line with the modern world and most importantly, the students. Marc Prensky is perhaps the most passionate expert I have come across in my research. It is likely through his extensive education that Prensky has developed his captivating voice as an internationally recognized speaker, writer, and visionary. Reflecting on his experiences as a teacher, consulter, founder, and CEO, it is apparent that Prensky keeps an open mind and does not hesitate to speak it. He has even coined two terms, 'digital native' and 'digital immigrant', which have since been added to the Oxford English Dictionary and the vocabulary of the digital learning community. In his book *Teaching Digital Natives, Partnering for Real Learning*, he defends that students today learn much more outside of school than in school. Through interaction with peers and digital technology such as the internet, YouTube, television, games, cell phones, etc., "kids are teaching themselves and each other all kinds of important and truly useful things about their real present and future" (Prensky,

2010). In making such a bold statement, Prensky asserts that many modern education systems are failing to evolve with the world. In his book, *From Digital Natives to Digital Wisdom*, he highlights:

> In the current environment, every field and job—from factory work to retail to healthcare to hospitality to garbage collection—is in the process of being transformed dramatically, and often recognizably, by technology and other forces…when leaders think that the job of educators is to re-create the old education better and more effectively for today's students, they deny our students the means to cope and thrive in the 21st century (Prensky, 2012).

When analyzing this perspective, it is eye-opening to reflect upon the fast-paced world that "digital natives" were born into. Prensky underscores the flaws of executive leaders in education, many of whom are "digital immigrants". He believes that the modern education system is failing to keep up in the digital era. In his book, *The World Needs a New Curriculum,* he claims that "today, we teach these most basic underlying skills extremely indirectly. In many cases we never even communicate to our students what the real underlying skills actually are." To explain this, Prensky describes the major disciplines of primary and secondary curricula (mathematics, language, science, and social studies) as "proxies". For example, algebra is a proxy for teaching abstract and symbolic thinking while science is a proxy for instilling inquiry and skepticism (Prensky, 2014). When dissecting his argument, it can be determined that while the underlying skills are essential, much of what students learn is not directly necessary to them. In summation, the digitalization of the modern world and the unique interests of beneficiaries should dictate the curricula that teachers provide. Thus, the current generation of 'digital natives' who become educators will likely connect more easily with the future 'digital native' generations, bringing the traditional model of education up to date.

Provider's Argument

In the exchange of views presented thus far, Bowen makes the justification that the immense collection of knowledge offered by digital technology is precisely why it is no longer necessary in American education. The Montessori method of teaching has also proven that digital technology is not necessary because the critical role of the teacher, as a human facilitator of student learning, is near impossible to replace with any digital technology. However, Jason Ravitz refutes this perspective by providing a bounty of credible data on how teachers back the power of technology in developing students' twenty-first century skills. Marc Prensky also disputes the negative argument by demanding that education systems be revolutionized to align with the digitalization of the modern world. When weighing these perspectives, experts on both sides use their heavy involvement within the field of education to craft strong arguments. Nevertheless, I feel that the debate favors technology for two main reasons. The combination of Ravitz' quantitative data and Prensky's qualitative data builds a more well-rounded defense. Furthermore, the dissenting argument seems to take a more passive stance, with Bowen's dispute exemplifying the negatives of an overwhelming plethora of resources and my defense focusing on how the Montessori method has persisted in modern times.

Beneficiaries

Another main challenge of increased digital technology use in education is the distracting effect it holds on students. Dr. Larry Rosen offers a scientific perspective as an international expert in the "psychology of technology". His recent investigations include generational differences in technology use and multitasking, the distracted mind from the dual perspectives of psychology and neuroscience, the impact of technology on health and sleep, integrating technology in education, and the impact of task switching during studying and in the classroom. Although Dr.

Rosen studies a variety of technology related fields and is no longer immersed in the education system, he has received high remarks on his seven books and countless publications. As a research psychologist and father of four, Rosen is making significant contributions in the fields of educational psychology and technology. (*About Dr. Rosen*, 2020). In 2013, he conducted a study involving 279 middle school, high school, and college students. After prompting them to study 'something very important' for 15 minutes in their normal workspace, he found that students at all levels only spent about 9.65 of the 15 minutes studying, with the most distracted students having the most digital devices. The students were observed studying for a few minutes and then getting off-task, repeatedly (Rosen, 2017). Based on the significant and varied sample, along with the naturalistic field environment, this study yielded representative results. However, in 2016, Rosen decided to replicate the research to confirm his findings. He was able to do so and also discovered that during distracted periods, students were occupied by communication technologies, such as texting and social media, over 75% of the time (Rosen, 2017). After studying the data collected by the Dr. Rosen and his colleagues, it can be determined that digital technology is an addicting distraction for students of varying grade levels, who were unable to focus their efforts on extremely important academic work for a relatively short time period. The positive correlation between the number of devices/windows open and lack of study concentration further illustrates the risks of digital technology in the twenty-first century American classroom. When weighing these results, it is clear that although digital technology may increase educational opportunities for student beneficiaries, it cannot be 'the key' to education if distraction from these same technologies is eating away at the modern-day students' attention span. Furthermore, another study conducted by Rosen emphasizes the harms of staring at smartphones use before bed, a common practice among students:

> … sleep plays an absolutely critical role in learning, allowing us to consolidate important information, rid ourselves of unwanted information, and dispose of stray toxic molecules left in the brain during the day… Most electronic devices emit light in the blue part of that spectrum, which tells the pineal gland to shut down the melatonin and orders the adrenal gland to secrete cortisol, which wakes people up… The upshot is that 80% of today's teens say they rarely or never sleep well (Rosen, 2017).

Through this study, Rosen declares sleep as a 'key' to education and most twenty-first century students are not getting enough of it. Digital technology, in the form of smartphones, is largely responsible for this and therefore promotes a lack of engagement during daytime studies. If digital technologies are overused, which has already been observed, their dangers will ultimately outweigh their benefits.

After exploring the Montessori method, where digital technology is rarely touched, it was natural to investigate the polar end of this educational spectrum: virtual school. The establishment of Florida Virtual School (FLVS) in 1997, as the first statewide online public school in America, has challenged the conventional learning environment. Over the past two decades, enrollment in virtual schools such as FLVS has grown, and with the COVID-19 pandemic, FLVS reported a 64% increase since the 2019-20 school year (Lieberman, 2020). Dr. Carycruz Bueno, a Teach for America Corp member and highly regarded educator, has a depth of research experience in applied microeconomics, including labor economics, health economics, and education economics. Despite her lack of direct expertise in educational technology, her analytical work on systematic dynamics makes her voice unique and valid for the purpose of this discourse. Additionally, her stellar academic record and passion for creating the best student learning experience is crucial when evaluating her high credibility as a source (*Carycruz Bueno | Economics PhD.*, 2020). Inspired by the events of the pandemic, she analyzed the efficacy of virtual school in a recent study. She strengthened her research by gaining access to a much wider set of data across multiple Georgia virtual schools, whereas previous studies only assessed one

institution at a time. Furthermore, she was able to collect longitudinal data over a period of ten years, allowing her to evaluate cumulative patterns. After aggregating the performance of thousands of students, she discovered that students who attended a full-time virtual school tested 0.1 to 0.4 standard deviations worse across English, mathematics, science, and social studies. Bueno also concluded that students who returned to a brick-and-mortar setting were able to compensate for their loss and return to pre-virtual school performance levels (Bueno, 2020). Interpreting the disparities between full-time virtual students and brick-and-mortar students illustrates the overall quality of education received by the two types of schools. When gauging virtual education in America, this study suggests that by replacing the central role of teachers with digital technology, beneficiaries will fall behind their non-virtual counterparts.

In the case of the COVID-19 pandemic, schools are recognizing the failures of temporary concurrent online teaching with most institutions forced to go fully remote at some point. Cynthia Saunders, superintendent of Manatee County school district, emphasizes how the pandemic has revealed that "our brick-and-mortar institutions, in the immediate future, or the next 50 years, are not going away" (Mckinnon, 2020). Her statement regarding remote learning supports Bueno's vindication of how detrimental virtual school is and how in-person learning produces the best student performance.

Contrary to Bueno's argument, Dr. Kelly Van Sande believes that virtual schooling can be designed to fill the holes of a traditional education. Since obtaining her master's in 'teaching and curriculum' and doctorate in 'educational leadership and administration', Van Sande has accumulated over a decade of online experience in K-12 online education and executive leadership. She has channeled her passion by founding Ignite Learning Academy (ILA), an

online school which aims to correct the failures of both brick-and-mortar and online education systems. Similar to the Montessori method which focuses on developing the whole child, ILA is tailored to the individual as both a student and person. As a parent herself, she illustrates her credibility and whole-hearted investment in designing a meaningful education and her two children are both enrolled in ILA (Ignite Learning Academy, 2021). In ILA's statement regarding who they serve,

> Through our years of experience in education, we found the traditional classroom setting may not be the most effective approach for your child's development. With our online program you and your child and can work closely with your academic advisor to determine the pace and approach that is best for your child (Ignite Learning Academy, 2021).

It is apparent that by using digital technology, Van Sande argues students and their families are able to develop one-on-one relationships with ILA faculty, which simply wouldn't be viable in a public or private school serving a large population. To expand upon the ways Van Sande's online school is serving students, ILA outlines five reasons why individuals may not fit the traditional school setting: different learning pace, lack of individualized attention, busy or inconsistent lifestyle, unsafe environment (physically, mentally, or emotionally), and overwhelming class sizes (Ignite Learning Academy, 2021). Ila is a prominent example of how digital technology should be used to better serve a wider range of students. Van Sande's argument asserts that every student is different and should have a conducive learning environment. Technology is the middleman that makes this possible and thus is necessary to a twenty-first century education.

Tom Vander Ark, CEO of Getting Smart, sees digital technology as a reformer, not merely a middleman. As a leading advocate for innovative learning, Vander Ark paves the path forward for schools, districts, networks, foundations, and learning organizations around the nation. Although his master's degree is in finance, he is a prolific writer and is the director of several education boards such as the Digital Learning Institute (Getting Smart, 2020). His active role in

the educational technology world makes him a strong expert and invaluable asset to this paper. In his book, *Getting Smart: How Digital Learning is Changing the World*, Vander Ark highlights that digital learning offers customization, motivation, and equalization (Vander Ark, 2012). When studying Vander Ark's argument, it is crucial to note that beyond an education tailored to the twenty-first century student learning style, digital platforms are an invaluable means of collecting data to analyze the most effective pedagogies for individual beneficiaries and beneficiaries as a whole. From this, an assessment can be made that digital technology catalyzes the continuous improvement of education systems to maximize student learning and is subsequently a key to education in the twenty-first century. Vander Ark's argument directly disputes those of Rosen and Bowen, who argue that digital technology is detrimental to student learning. While Rosen and Bowen underscore the threat of the overwhelming accessibility to unlimited information, Vander Ark argues that insightful information can be extracted from digital learning in order to improve these flaws.

In support of Vander Ark's difference of opinion with Rosen and Bowen, many educational entrepreneurs are aggregating, selecting, and rephrasing credible information to benefit the twenty-first century student through comprehensive videos. Perhaps the most prominent platforms include Khan Academy and Crash Course, which provide high quality content within relatively short, learning intense video segments. Khan Academy offers educational videos across multiple disciplines, along with individualized test preparation programs for standardized exams, such as the SAT, Praxis, and LSAT (Khan Academy, 2021). Crash Course uploads free, power-packed videos on their YouTube channel, which has gained popularity among anxious students preparing for a test and casual learners yearning for new knowledge (Crash Course, 2021). Personally, I have utilized both Khan Academy and Crash Course to supplement

perplexing content taught in class and have found their well-scripted videos to be extremely helpful in grasping abstract concepts. Through Khan Academy's SAT resources which focus on foundational reading, grammar, and math skills, I have reaped the reward of exponential score improvements, which has likely raised my potential of getting into college. But beyond tangible achievements, these platforms have evoked great fascination for learning topics that I never would have imagined. For millions of students like me, digital technology is stretching the possibilities for learning by instilling passion and curiosity**,** while providing customized feedback.

Beneficiary's Argument

In this lens, Rosen and Bueno have supplied concrete data on how digital learning is harming student performance. From eating away at attention spans to disrupting sleep, Rosen provides great insight into the dangers of technology addiction. Meanwhile, Bueno warns that full-time virtual students are performing significantly worse than their brick-and-mortar counterparts, indicating that the digital technology learning environment is not adequate enough. Van Sande contradicts this perspective by demonstrating the potential of online schools to serve nontraditional learning styles through the creation of her own Ignite Learning Academy. Vander Ark supports this by highlighting the ability of technology to mitigate educational limitations through keystroke data and providing insight into how improve the system. Under this methodology, I have found Rosen's statistical data against digital technology and Van Sande's qualitative data in support of digital technology to be particularly compelling. Hence, it was Vander Ark's optimistic outlook of using technological data analysis as a means of educational enhancement that pushed me towards the positive side.

Conclusion

In the midst of researching this multifaceted argument, I was concerned that I would fail to fully represent the various perspectives of providers and beneficiaries given the word constraints of this report. So far, however, I feel this methodology has been successful and I have been able to give equal justice under each lens. Upon further reflection of my alternate methodology, I am relieved I chose this division because while my evidence is well-rounded across the formal American education years, it would have been difficult to find evidence exclusive to each of the primary, secondary, and post-secondary years. Additionally, the balance between quantitative and qualitative data allowed me to gain a depth of knowledge on the essence of each expert's arguments while also being able to validate them with concrete numbers.

Through diving deep into these arguments, I have gained a much deeper appreciation for non-digital learning and attribute much of my current academic success to the hands-on learning experience and nurturing environment of my Montessori education. Nevertheless, my own standpoint has only strengthened because I realize that the invaluable skills I have developed through online education will only serve as assets as I transition into higher education and professional life. Furthermore, my remote learning experience this past year has challenged me to reevaluate the purpose of education. While I have always been a straight-A student, I believe my detachment from the traditional school setting and increased access to technology has inspired me to research the wider contexts of the concepts I am learning and analyze their impacts on my life. So although digital technology may not have been the key to education in the twentieth century, the digitalization of the twenty-first century makes it essential.