Bridging Socioeconomic Gaps: An Analysis of Persisting Inequity in the Education System

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Michael Kirk

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Caitlin D. Wylie, Department of Engineering and Society

Introduction

Inequity persists in education and affects students across the world, even in the most developed countries (United Nations, n.d.). Efforts to address these inequities have not been sufficient to eliminate them from educational systems. This is a problem because education is a vital pillar of a functional, fair society. Education is a social determinant of health for individuals, has a large impact on a country's economic output, and can help serve as a great equalizer for individuals below the poverty line (Hahn & Truman, 2015; UNESCO, 2017). For these reasons, it is critical to address the inequity promptly if society is to progress effectively.

Education is often viewed as one of the most effective tools to combat poverty internationally. The United Nations Educational, Scientific and Cultural Organization (UNESCO) estimated in a 2017 policy report that if all adults completed a secondary education, the worldwide poverty rate would be nearly halved (UNESCO, 2017). According to the same report, even aside from completing a full secondary education, just increasing the years of schooling of individuals 15 years or older by two years would raise 60 million people out of poverty. While education serves as one of the best ways to break poverty cycles and give students the chance to elevate their socioeconomic status (SES), there are disparities that currently prevent education from providing the socioeconomic mobility that it should.

There is a set of terminology that should be defined and explained when discussing inequity in education. SES is a term frequently used when discussing inequity, inequality, and disparities on a social and economic level. The American Psychological Association, a reputable national professional organization, defines SES as a term encompassing status in terms of "not only income but also educational attainment, occupational prestige, and subjective perceptions of social status and social class" (American Psychological Association, n.d.). In a social context,

inequality and inequity are terms often used interchangeably; however, while they are related, they have different meanings that are important to clarify (Soken-Huberty, n.d.). Inequity refers to a lack of equity, meaning a lack of justice or fairness, while inequality is used to describe a result of inequity. In education, an example of this delineation would be a lack of equity for minority communities, which leads to unequal education outcomes. When it comes to technology in education, there are disparities between students that have access to devices and the internet, and those that do not. This is often referred to as the "Digital Access Divide," defined by the US Office of Educational Technology as the divide that "stands between those students and educators who have equitable, sustainable access to connectivity, devices, and digital content and those who do not" (Office of Educational Technology, 2024). The term "equal access" is also used frequently in this paper, which refers to students having equal ability to access devices and the internet.

The theories of utilitarianism and virtue ethics are referenced in this research. Utilitarianism is an ethics theory that focuses on maximizing good for the largest number of people (University of Texas, n.d.). Virtue ethics is an ethical theory that emphasizes actions that reflect being ethically and morally good (University of Texas, n.d.). The stances taken in this research are that utilitarianism would support equal education, so long as it is achievable without greatly harming the education of the majority. This is because an educated society tends to be more productive and prosperous overall (Berger & Fisher, 2013). From a virtue ethics perspective, the stance is that it is morally good for all individuals to have equal quality and access levels in education, so society is obligated to strive for this.

A Brief History of Inequity in Education

Throughout the history of the United States, inequity in education has plagued many communities, inherently placing them at a disadvantage. The roots of the inequity lie in racial inequality and segregation and have since grown to affect members of all disadvantaged communities. In an analysis of an excerpt from reputable historian Carter Woodson, Harvard University Press stated that up until slavery was abolished in the United States in 1865, most Black Americans, free or enslaved, were blocked from obtaining education in any capacity (*The Origin Story of Black Education*, 2022). They would have to resort to sneaking books and acquiring knowledge in ways that were often outlawed. In the US South, not only was education prevented, but there were also laws in place to directly combat things like literacy for free and enslaved Black people, known as anti-literacy laws (*The Origin Story of Black Education*, 2022). Any exception was typically through a privately funded institute. After the US Civil War (1861-1865) ended, legislation was passed starting to support the education of people of color, starting as early as 1865 in some states like Georgia (Butchart, 2020). They were to attend schools that were separated from the white students. The National Museum of African American History and Culture (NMAAHC), a well-respected and credible Smithsonian institution, has published articles describing conditions of segregated schools ("The Struggle Against", n.d.); The segregated schools attended by people of color were often unsafe buildings surrounded by poor infrastructure. They lacked educational resources for their students, and Black teachers were paid far less than their white counterparts. The effects of "separate but equal" treatment were reflected in the academic performance across demographics. The American University School of Education states that in 1950, 1 in 10 Black adults had graduated from high school compared to 4 in 10 white adults ("Classroom Segregation", 2020). In areas that had stricter, more oppressive

laws, the effects were greater: Black adults across multiple Southern states only had an average of five years of education.

Segregation remained in the education system until it was banned by the Supreme Court in 1954. It took varying amounts of time for schools to be fully desegregated across the US, with some states like Virginia taking until the 1970s to stop resisting desegregation (Daugherity, 2020). Studies conducted on the long-term effects of desegregation of schools found profound effects on the Black community: each year a child was exposed to a desegregated school, their likelihood of graduating increased between 1.3 and 2.9% (Johnson, 2011). For Black men, attending a desegregated school as a child decreased the likelihood of spending time in jail before the age of 30 by nearly 15%. It is worth noting that throughout the history of segregation of schools, there were other minority groups that were affected by these laws; however, Black citizens are most discussed because most legislation targeted them specifically.

The actions of educating Black Americans and desegregating schools align with virtue ethics and utilitarianism: it is fair and virtuous that all individuals have equal access to quality education and an educated society tends to be most productive (Berger & Fisher, 2013). There is suggestive evidence that desegregating schools without changing resource allocation did not have long-term impacts on achievement level. The implication suggests that the problem may have come more from the inequity in the system that came from segregation rather than segregation itself (Johnson, 2011). This observation helps explain why inequity persists long after desegregation occurred and why research today suggests education quality is related to the SES background of a student and school resources.

Socioeconomic Status Impact on Education

Historical segregation and systemic racism against people of color laid the groundwork for the inequity in society and education that has now permeated the boundary of race. Race-based legislation has been dismantled; however, inequity persists throughout the education system. Now, many marginalized and minority communities struggle with the inequity in education that people of color faced during segregation. The boundary, instead of being legal separation, is now SES. SES has been found to correlate profoundly with both the quality of education a student will receive and a student's educational outcomes. The effect likely comes from SES influencing the student's access level to educational resources at home, the funding their school system receives, and other factors. Some of the correlations with students having low SES include them being less likely to pursue higher education and poorer academic performance, including test scores and literacy/reading level (Bradley, 2023).

The link between SES and education is both a domestic and international issue. The Organization for Economic Cooperation and Development (OECD) is an international organization. Their participant countries represent approximately 80% of global trade. In 2018, OECD found that, in their participant countries, the top 10% and bottom 10% of the socioeconomic spectrum had a literacy gap of three years of education. Domestically, students from low SES backgrounds typically attend schools with less funding and fewer resources, leading them to underperform high SES students by 20-26% in standardized testing (Bradley, 2023).

The influence of a student's SES pervades throughout all education levels, including higher education. According to data from the Common App, a universal platform for college applications used by institutions nationwide, 56% of their applicants come from the most affluent

quintile of zip codes. In the meantime, only 6% come from the bottom quintile (Magouirk et al., 2023). High SES students are also four times more likely to graduate from higher education (Bradley, 2023).

To best understand how inequity affects students, it is important to analyze the mechanisms in which SES impacts students during their education, not just its impact on educational outcome. The National Center for Children in Poverty published research giving insight into the consequences of students growing up in a low SES situation: "These children are more likely to experience multiple family transitions, move frequently, and change schools.[2] The schools they attend are less well funded, and the neighborhoods they live in are more disadvantaged.[3] The parents of these children have fewer resources to invest in them and, as a consequence, their homes have fewer cognitively-stimulating materials, and their parents invest less in their education[4]" (Wagmiller & Adelman, 2009, p. 1). These aspects, in congruence with each other, add stressors to low SES students that other students most likely do not experience. While some of these challenges may take away directly from a student's ability to focus on school by occupying time or preventing attendance, some add psychological stress. The cognitive appraisal theory of stress, developed by psychologist Richard Lazarus, suggests that stress is the imbalance between pressure placed on an individual to perform and their resources to properly cope (Deng et al., 2022). Research conducted based on this theory has found that family and academic stress lead to depression among students, therefore negatively impacting their academic performance and outcomes (Deng et al., 2022). This means that low SES students are fighting a multi-front battle in the education system, dealing with direct and indirect external stressors, as well as experiencing education in schools that are typically under-resourced.

Technology Can Deepen the Divide Caused by SES

Reliance on technology in education can both support and impede the success of low SES students. The IEEE, a reputable digital technology organization, has published information on the theory of the Digital Divide. It explores the digital divide as a rift between those that have access to digital technology and those that do not. For example, a low SES student without a local library may gain access to countless books and educational resources through an eBook reader provided to them from their school. Another student may be assigned online learning materials and because their school did not provide them with a device and they lack one at home, they are unable to complete their assigned work. Lacking access to technology also leaves students with less familiarity with the platforms. This familiarity and ability to use technology effectively is referred to as "digital literacy" (University of San Diego, n.d.). Lacking digital literacy places students at a disadvantage, not just in school, but later in life in their potential professional fields.

The problems associated with technology in this case are rarely from the technology itself. Instead, the problems stem from relying on technology without properly supporting access to it, both in school and at home. This can place low SES students at a further disadvantage compared to their peers, as not only is the quality of their education lower, but their access to it is also more limited. A 2022 survey by the ACT Center for Equity in Learning found that 14% of students (that participated in ACT Testing for college admissions) had access to only one device at home. Though speculation, it is likely the figure representing the US population is even more staggering. As referenced previously, Common App data shows a large disparity between college applications based on SES, and because the ACT is a test typically taken by those intending to attend college, the data is skewed and under-represents the population of students with only one

device at home. This extrapolation assumes that one-device homes tend to be families of lower SES background, and thus, they are less likely to attend college; therefore, data from students planning to attend college would under-represent this group.

The IEEE believes the digital divide may be worsening, with over 3.7 billion people being unconnected across the world ("What Is the Digital Divide?", n.d.). The digital divide gives insight to explanations for the inequity that is arising from the use of technology in education: it is reasonable to extrapolate that as technology continues to develop faster, the gaps in technology access grow, and the effects of those gaps are felt more. The IEEE confirms this by explaining that as technology develops more quickly, those lacking access are left behind faster. It is predicted that as parts of the world get to new levels of technical advancement, there are disparities that will be irreparable ("What Is the Digital Divide?", n.d.).

Covid 19's Impact on Education and Inequity

The Covid-19 pandemic serves as an excellent case study to give insight into how students of lower SES background are disproportionately affected by inequity and the digital divide. In terms of technology, increased reliance on virtual learning (VL) during the Pandemic exacerbated issues that arise from the gaps explained by the digital divide. Students lacking devices at home and internet access were challenged with the sudden change to a VL-reliant form of instruction. In September of 2020, the United States Census Bureau, a government bureau responsible for conducting studies related and not limited to demographics and economics, found that approximately 4.4 million households with children (8.5% of respondents) lacked consistent access to computers for online learning nearly six months into the pandemic. From the same survey, similarly, 3.7 million households with children (7.3% of respondents) had internet access "sometimes, rarely, or never." Of students with consistent access to a device, 60%

had devices provided by the school. Of students with consistent internet access, 2.4% had received internet access from the school. The disparity between schools providing devices compared to internet access is not a perfect link; however, it suggests that internet access for students could be just as large a problem as access to technology. Another study during the pandemic (2020) showed that in the US, 73 of the largest 100 school districts in the nation were instructing entirely online. Of students that came from low-income households, 36% could not complete their schoolwork because technology was inaccessible (American University, 2020).

Later data from the Census Bureau indicate challenges with equal access conditions improved over the course of the pandemic. When they conducted another survey in June of 2021, 6.5% of responding households with children said they had devices for educational purposes sometimes, rarely, or never. That is a 23.6% relative decrease, from 8.5% in September of 2020. The same report showed that 6% of households with children had internet access sometimes, rarely, or never, a 17.8% decrease from the September 2020 survey. Without extensive analysis and extrapolation, it is hard to say where the improvements came from, but they are worth noting and may be worth exploring in future work on the topic.

Current Efforts to Bolster Equal Access to Technology

While technology has highlighted many of the inequities in education, and in some ways worsened the problems due to unequal access, there are individuals and organizations at various levels that are currently working to address these issues. Some of the groups fighting inequity are private, for-profit businesses, while others are non-profits or government programs. It is possible that, with enough time, equal access will be provided to a level where technology no longer increases the potential for inequity. This section will examine case studies of some of these organizations to understand their impact and how they are addressing the digital divide. While

some efforts do not directly address issues with technology in education, efforts that increase equal access to technology in any avenue parallel and directly influence how the effects of the digital divide are felt in education.

Several nonprofits are seeking to increase equal access to technology across the country. EveryoneOn is one such nonprofit organization operating nationally to address issues with digital literacy, access, and other issues with the digital divide (EveryoneOn, n.d.). They provide a multitude of services: assistance to individuals who wish to enroll in low-cost internet service, a "Digital Skills Academy" where they teach digital literacy, a nationwide tool that helps locate local low-cost internet and affordable devices such as computers and laptops, and more. According to their 2022 impact report, since 2012, EveryoneOn had helped connect over one million people to the internet and given out over 10,000 devices. They provided skill training to 4,000 people over the prior three years (EveryoneOn, 2023).

In addition to non-profit organizations, many for-profit companies are also aiding in addressing the Digital Divide. Silicon Harlem is a company based in Harlem, a neighborhood in the Upper Manhattan area of New York City. Silicon Harlem provides affordable, sometimes free, high-speed internet to the areas they serve. They established a non-profit organization that is "dedicated to connecting underserved communities to economic opportunities via technology access and education" (Silicon Harlem).

On a large scale, companies like Microsoft often provide support to students in underserved communities. One Microsoft report from 2017 states that they provided over $75 million in grants to help increase access to computer science (CS) education; more than 80% of the students benefiting from the grants were from underserved communities, and more than half were women, who are often under-represented in the field (Microsoft, 2017).

While these efforts can serve as a steppingstone to addressing the issues, there is little research collected on how effective they have been. The case studies give good insight into examples of how inequity is being fought; however, they do not give perspective on how effective they collectively have been on a broader scale. This raises meaningful questions: Which programs have most significantly impacted classroom experiences for lower SES students? Among nonprofits, for-profits, and government programs, which have been most effective at reducing inequities? Could these efforts be scaled enough to combat and potentially reverse the digital divide? All these questions serve as grounds for further research that could aid in fighting inequity in an effective and targeted manner.

Conclusion

Despite the efforts being made to address inequity in education, there still exist great disparities between different social groups. Today, there are significant gaps in access levels of technology for students, as described by the digital divide. Both utilitarianism and virtue ethics indicate these inequities should be addressed. SES has a strong correlation with a student's ability to have equal access to the technology that is often utilized in classrooms. The Covid 19 pandemic only exacerbated these gaps and highlighted how disproportionately education for minority communities and low SES background students can be affected during times of crisis. Future research should aim to find what efforts were most successful in addressing inequities. With education being so important to a productive and future-looking society, it is vital that these inequities are addressed promptly and research deducing the most efficacious strategies would be invaluable in solving the crisis of inequity.

References

2022 Impact Report. (2023, November 17). EveryoneOn: About Us. Retrieved from https://www.everyoneon.org/about-us#mission.

ACT Center for Equity in Learning. (2022, March 9). Unequal access to technology prevents educational equity. Giving Compass. https://givingcompass.org/article/unequal-access-to-technology-prevents-educational-equity#:~:text=Research%20from%20the%20ACT%20Center,their%20long%2Dterm%20academic%20success

American Psychological Association. (n.d.). Socioeconomic status. American Psychological Association. https://www.apa.org/topics/socioeconomic-status

American University. (2020, December 15). Understanding the digital divide in Education. School of Education Online. https://soeonline.american.edu/blog/digital-divide-in-education/

Berger, N., & Fisher, P. (2013, August 22). A well-educated workforce is key to state prosperity. Economic Policy Institute. https://www.epi.org/publication/states-education-productivity-growth-foundations/

Bradley, K. (2023, August 2). The socioeconomic achievement gap in the US public schools. Ballard Brief. https://ballardbrief.byu.edu/issue-briefs/the-socioeconomic-achievement-Gap-in-the-us-public-schools

Butchart, Ronald. "Freedmen's Education during Reconstruction." New Georgia Encyclopedia, last modified Sep 16, 2020. https://www.georgiaencyclopedia.org/articles/history-archaeology/freedmens-education-during-reconstruction/

C-Better. (n.d.). Educate - C-better. C-Better. https://cbetter.org/educate

Classroom Segregation: History and Current Impact on Student Education. School of Education Online. (2020, August 19). https://soeonline.american.edu/blog/classroom-segregation/

Daugherity, Brian. Desegregation in Public Schools. (2020, December 07). In Encyclopedia Virginia. https://encyclopediavirginia.org/entries/desegregation-in-public-schools.

Deng, Y., Cherian, J., Khan, N. U., Kumari, K., Sial, M. S., Comite, U., Gavurova, B., & Popp, J. (2022). Long-Run Impacts of School Desegregation & School Quality on Adult Attainments family and Academic Stress and Their Impact on Students' Depression Level and Academic Performance. Frontiers in Psychiatry, 13. https://doi.org/10.3389/fpsyt.2022.869337

EveryoneOn. (n.d.). Programs. EveryoneOn. https://www.everyoneon.org/programs

Hahn, R. A., & Truman, B. I. (2015). Education improves public health and promotes health equity. International Journal of Health Services, 45(4), 657–678. https://doi.org/10.1177/0020731415585986

Johnson, R. (2011). Long-Run Impacts of School Desegregation & School Quality on Adult Attainments. National Bureau of Economic Research. https://doi.org/10.3386/w16664

Magouirk, P., Freeman, M., Kajikawa, T., Karimi, H., & Kim, B. H. (2023, January 11). DeadlineUpdate_010323.pdf. Common App.

Microsoft. (2017, May). Education Fact Sheet.

Sahlberg, P. (2020). Does the pandemic help us make education more equitable? Educational Research for Policy and Practice, 20(1), 11–18. https://doi.org/10.1007/s10671-020-09284-4

Silicon Harlem. (n.d.). https://siliconharlem.com/

Soken-Huberty, E. (n.d.). Inequity vs. inequality: An Explainer. Human Rights Careers. https://www.humanrightscareers.com/issues/inequity-vs-inequality-an-explainer/

The Digital Access Divide. Office of Educational Technology. (2024, January 22). https://tech.ed.gov/netp/digital-access-divide/

The Origin Story of Black Education. (2022, February 1). Harvard University Press | Blog. April 4, 2024, https://harvardpress.typepad.com/hup_publicity/2022/02/the-origin-story-of-black-education.html

The Struggle Against Segregated Education. National Museum of African American History and Culture. (n.d.). https://nmaahc.si.edu/explore/stories/struggle-against-segregated-education#:~:text=Classrooms%20were%20poorly%20resourced%2C%20without,salary%20of%20their%20white%20counterparts.

UNESCO. (2017, June). Reducing global poverty through universal primary and secondary education. POLICY PAPER 32/FACT SHEET 44

United Nations. (n.d.). Recognizing and overcoming inequity in education. United Nations. https://www.un.org/en/un-chronicle/recognizing-and-overcoming-inequity-education

University of Texas. (n.d.). Utilitarianism. Ethics Unwrapped. https://ethicsunwrapped.utexas.edu/glossary/utilitarianism

University of Texas. (n.d.). Virtue Ethics. Ethics Unwrapped. https://ethicsunwrapped.utexas.edu/glossary/virtue-ethics

US Census Bureau (2020, September 23). Week 14 household pulse survey: September 2 – September 14. Census.gov. https://www.census.gov/data/tables/2020/demo/hhp/hhp14.html

US Census Bureau (2021, June 30). Week 32 household pulse survey: June 9 – June 21. Census.gov. https://www.census.gov/data/tables/2021/demo/hhp/hhp32.html

Wagmiller, R. L., & Adelman, R. M. (2009, November). Childhood and intergenerational poverty: The long-term consequences of growing up poor. National Center for Children in Poverty. https://www.nccp.org/publication/childhood-and-intergenerational-poverty/#:~:text=Intergenerational%20Poverty%3A%20The%20Consequences%20of,in%20early%20and%20middle%20adulthood

What is Digital Literacy? A complete guide for educators. University of San Diego - Professional & Continuing Education. (n.d.). https://pce.sandiego.edu/digital-literacy/

What Is the Digital Divide? IEEE: Connecting the Unconnected. (n.d.). https://ctu.ieee.org/what-is-the-digital-divide/