The University of Chicago

The New AI Powered Classroom
Implications for Students, Teachers, and Equity

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Abstract

Following President Trump's Executive Order on Advancing Artificial Intelligence Education for American Youth in April 2025, a new national vision of AI emerged in classrooms meant to meet job market demands and keep up with international competition. The new AI-powered classroom is envisioned as a world where AI becomes an educator. AI provides instructional material, analyzes student performance in real time, and adapts to student needs at unprecedented speeds. While many AI enthusiasts may call this an opportunity to bridge the achievement gap, I propose that AI instruction is likely to exacerbate current structural inequalities pertaining to unequal funding, infrastructure, and support. In this paper, I will utilize California as a case study due to its proximity to Silicon Valley and its elevated levels of income inequality to investigate the implications AI has on students, teachers, and equity. Through an integrated study of (1) interviews with professors at the University of Chicago and primary school teachers in California and (2) a quantitative exploratory data analysis of student outcomes, I outline current barriers to equity and the effects of AI on education.

Dedication

To my parents, Luis Medina, and Maria Delfin, who I owe my whole life to. To my sister, Victoria Medina. I am forever thankful for their love, encouragement, and support.

Acknowledgements

First, I am thankful to the University of Chicago for giving me the platform to explore my inner curiosity and push the limits of self-discovery in addition to QuestBridge who made this journey possible.

Second, I am grateful to the following professors: Michael Watts, Sarah Fredericks, Micere Keels, and Lisa Rosen. Each one of these professors has intrinsically motivated me to understand social disparities. I am thankful to Chad Broughton who guided me on my project.

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I. Introduction

AI is a mirror to society. In its reflection, persistent inequalities become visible. Education makes the image of inequality even clearer. The use of AI became controversial due to its perceived novelty in the field. Following the release of ChatGPT in 2022, AI and other digital tools became accessible to educators causing action and discourse on educational reform [1]. President Trump released an Executive Order in April 2025 "Advancing Artificial Intelligence Education in American Youth", encouraging state adoption of AI policy in literacy and curriculum to "propel the nation to new heights" [2]. Every state has developed its own policy for AI in education with California's policy shaped by Silicon Valley's influence. Ravi Narayana, an AI expert in business and analytics once said: "AI is a mirror reflecting not only our intellect, but our values and fears" [3].

Fig. 1. Михаил Секацкий, Person in black long sleeve shirt, 2021. Photography. Unsplash.

What are the values we, as a society, hold today? If two schools from different socioeconomic status backgrounds are compared, the answer is revealed. Financial capital is

[1] Al Shloul et al., "Role of Activity Based Learning and ChatGPT on Students' Performance in Education," Computers and Education. Artificial Intelligence 6 (2024): 19, https://doi.org/10/1016/j.caeai.2024.100219.

[2] Donald Trump, "Advancing Artificial Intelligence Education for American Youth" (The White House, April 23, 2025)

[3] Boone, "Top 10 Thought-Provoking Quotes" (Nisum, 2023)

everything in a capitalist economy. By consequence, low-income communities and minority communities are not given the same opportunities as more affluent communities both historically and in present-day [4]. The wealth portrayed in Silicon Valley, the hub of AI innovation and technology, is affecting every industry and sector across the United States and the world. In response, children are prepared unevenly to enter a workforce that is changing every day, creating an uncertain future. AI enthusiasts promote the promising potential of closing persistent achievement gaps with "AI powered classrooms"[5]. AI powered classrooms can be defined as a classroom environment in which artificial intelligence systems take over teacher personalized instruction adapting to student's individual needs [6]. AI is framed as the ideal vision for quality education equalizing conditions for all students. Although AI classrooms are a potential great equalizer tool for education, there is a concern whether this takeover of education places a priority on productivity rather than genuine learning comprehension.

I reflect on Horace Mann's remark on public school education as "the great equalizer"[7] In theory, the public school system was meant to provide all students with an equal learning environment, laying the grounds for social mobility and opportunity of life. Educational outcomes can be understood as a student's ability to achieve higher academic performance, which can lead to greater socioeconomic status through higher education or job attainment. Despite the grand utopia of it all, education historically excludes students of color and minorities from participating in opportunities, especially those from a low-income background.

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[4] Darling-Hammond, "Inequality in Teaching and Schooling" (2001)

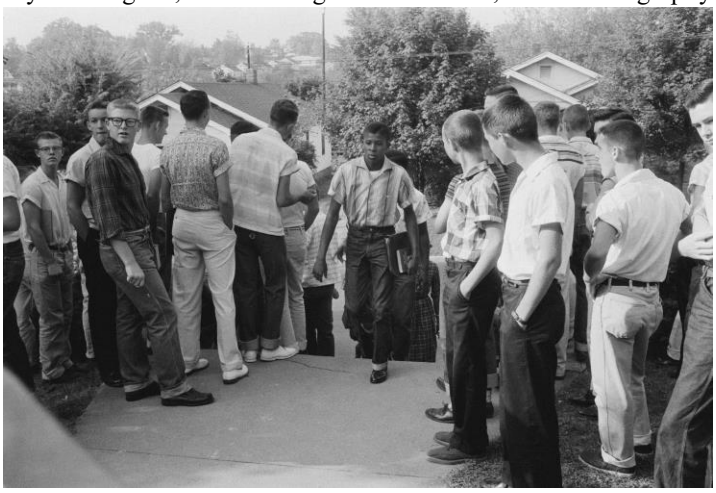
[5] Sylvestre, Stephanie, "Harnessing the Power of Generative AI to Close the Achievement Gap" (2023)

[6] Buşu, "AI-Powered Classrooms," (2024)

[7] Growe and Montgomery, "Education Equity in America"(2003)

To this day, education continues to reflect inequalities in society. Government policies influenced by racial ideology enforced neighborhood segregation applied through zoning laws and urban renewal projects that left a legacy of under-funded schools and infrastructure [8]. Even if AI is used to help students prepare the workforce, it may be skewed more towards districts with proper infrastructure, funding, and support. Thus, AI would favor wealthier districts reflecting an intrinsic value of U.S. society and economy that only rewards the wealthy. The distribution of wealth goes beyond class based since it is influenced by racial and ethnic lines as well. The fight for equity continues despite innovation promising equal outcomes for all students. When the government is pushing for innovation, who can reap the benefits of an AI-powered classroom?

Fig. 2. Library of Congress, School Integration Conflicts, 2023. Photography. Unsplash.



At the forefront, creating pressures for AI incorporation are the dominant powers in society, namely the government. With the emergence of Artificial Intelligence (AI), an international arms race commenced, with each country wanting to adapt to the changing, competitive global trends [9]. Competition is the main driver of innovation [10]. Thus, unregulated

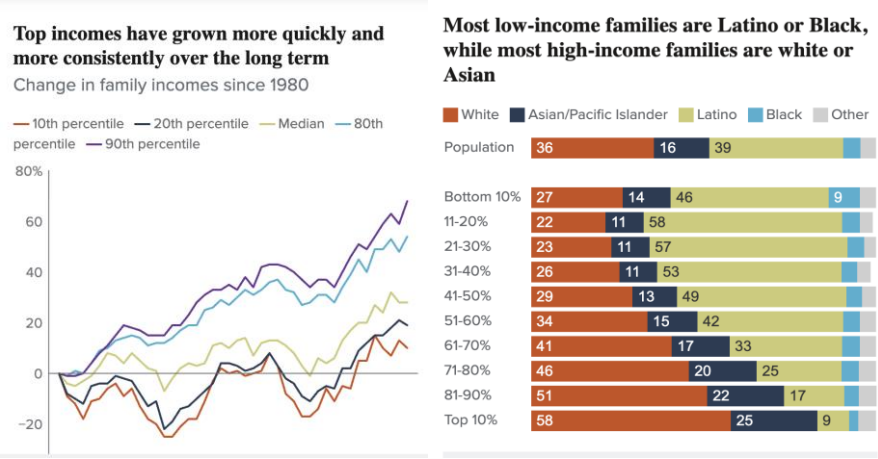
[8] Darling-Hammond, "Inequality in Teaching and Schooling"(2021)

[9] Lewis, "AI and Arms Races."(2025, CEPA)

[10] Nicholas, "What Drives Innovation" (2010)

development in AI generative tools has resulted in its expansive use due to its coupled free access. Trump's Executive Order reflects the fear that the United States will not remain a global leader in this technological revolution. Due to each state's differing AI policies, it is difficult to reconcile the appropriate funding, privacy, human oversight, and teacher training necessary to scale up this project to a national level. Take California for instance in Figure 3, there is a large income gap that remains despite the large concentration of wealth. Over time, high income individuals, mostly White and Asian, face more economic growth in the long-term. Meanwhile, the bottom percent of low-income families face more unpredictable changes, which is a demographic that tends to be mostly Black and Latino [11].

Fig. 3. Thorman, Montoya & Herrera, Income Inequality in California, 2023. Chart. Public Policy Institute of California.



The problem of integrating AI in education lies with the potential unequal access and persistent inequalities that may trouble its implementation in classrooms. This paper explores whether AI in education will serve as an equalizer or if its anticipated return on investment will

[11] Thorman, Payares-Montoya, and Herrera, "Income Inequality."

be offset by out-of-school inequalities. I will focus on the state of California by relating to discussions in academic circles and the real-world implications on students and teachers within a K-12 environment. The study narrows the line of focus on elementary school where knowledge is foundational. In a comparative analysis, I examine the gaps between AI policy and practice within California district schools leading to "AI achievement gaps" that are rooted in socioeconomic conditions.

II. Background/ Literature Review

The Tenth Amendment states:

> The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people [12].

The federal executive order has limited power in enforcing real change in the realm of education beyond the influence of authority and grants. Education is not explicitly mentioned in the Constitution, so states are the main policymakers in that realm. In 2025, there have been many changes in AI education policy in the state of California. The pressure to enact proposals and enact AI policy has been present since 2021 on an international level.

[12] Frazzini, "FAQ: The Education Department"

Fig 4. 2021 International AI and Education Policy Approaches [13]

Country	Document Name	Date	Education for AI			AI for Education		Context	
			Training AI Experts	Preparing Workforce for AI	Public AI Literacy	Teaching and Learning	Admin. Tools	Education as Priority Topic	AI for Health
Australia	Artificial Intelligence: Australia's Ethics Framework (A Discussion Paper)	########	x	x	x		~		x
Austria	Shaping the Future of Austria with Robotics and Artificial Intelligence	########	x	x	x			x	x
China	A next-generation artificial intelligence development plan	########	x		x	x	x	x	x
Denmark	National Strategy for Artificial Intelligence	########	x	x	x			x	x
Estonia	Estonia's national artificial intelligence strategy 2019-2021	########	x		x			x	
Finland	Finland's Age of Artificial Intelligence: Turning Finland into a leading country in the application of artificial intelligence	########	x	x	x			x	x
France	For a Meaningful Artificial Intelligence: Towards a French and European Strategy	########	x	x				x	x
Germany	National Strategy for Artificial Intelligence: AI Made in Germany	########	x	x	x			x	x
India	National Strategy for Artificial Intelligence: #AIForAll	########	x	x	x	x	x	x	x
Italy	Artificial Intelligence at the service of citizens	########	x	x	x	x		x	x
Japan	Artificial Intelligence Technology Strategy	########	x	x					x
Kenya	Emerging Digital Technologies for Kenya: Exploration & Analysis	########		x	x	x	x	x	x
Lithuania	Lithuanian Artificial Intelligence Strategy: A Vision of the Future	########	x	x	x			x	x
Malta	Malta: Towards An AI Strategy	########	x	x	x	x	x		~
Mexico	Towards an AI Strategy in Mexico: Harnessing the AI Revolution	########	x	x	~	~		x	x
Norway	National Strategy for Artificial Intelligence	########	x	x	x			x	x
Qatar	Blueprint: National Artificial Intelligence Strategy for Qatar	########	x	x	x			x	x
Russia	National Strategy for the Development of Artificial Intelligence Over the Period Extending up to the Year 2030	########	x	x	x	~		x	x
Singapore	National Artificial Intelligence Strategy: Advancing Our Smart Nation Journey	########	x	x	x	x		x	x
South Korea	Mid-to Long-term Master Plan in Preparation for the Intelligent Information Society: Managing the Fourth Industrial Revolution	########	x	x	x	x		x	x
Spain	Spanish RDI Strategy in Artificial Intelligence	########	x	x	x	x	x	x	x
Sweden	National approach for artificial intelligence	########	x	~				x	~
United Kingdom	AI in the UK: Ready, Willing and able?	########	x	x	x			x	x
United States	The National Artificial Intelligence Research and Development Strategic Plan	########		x		x		x	x

There was a common observance of teaching about AI in education, but no policy that gave guidance on AI integration with education only*(9/24 countries), This article was since then published by multiple federal departments in the US, Adapted from Schiff 2021 [13].

AI State policy in California

A direct statement from Governor Gavin Newsom of California:

> California has proven that we can establish regulations to protect our communities while also ensuring that the growing AI industry continues to thrive. This legislation strikes that balance. AI is the new frontier in innovation, and California is not only here for it- but stands strong as a national leader by enacting the first-in-the-nation frontier AI safety legislation that builds public trust as this emerging technology rapidly evolves [14].

California has a strong foothold in the AI industry. Newsom prides himself in this fact when he flaunts California as the birthplace of AI and the "home to 32 of the 50 top AI companies"[15]. Despite the great praise AI developers receive from the governor, California has

[13] Schiff, "Education for AI,"

[14] Governor of California, "Governor Newsom Signs SB 53."

[15] Governor of California, "Governor Newsom Signs SB 53"

passed a series of laws aimed to keep AI safe for students. The California SB 53 of 2024 requires AI developers to enable systems to be transparent, safe, and accountable as an obligation [16]. Soon after, Newsom also signed Assembly Bill SB 2876 into law to integrate AI literacy into K-12 education for all subjects [17]. That same year, he also signed the Assembly Bill SB 1288, creating the Artificial Intelligence Working group in the California Department of Education to develop model policy on AI that considers equitable access, privacy, integration, and professional learning [18]. Even when safeguards are placed, there is doubt whether this will be enough and if equitable implementation for AI will be possible.

The series of bills signed by Governor Newsom is to generate a safe AI environment for students to use in their day-to-day classroom. Cognizant of bias and privacy issues, California aims has placed guardrails and data ethics for AI developers as a requirement to ensure safety. California's proximity to partnerships and innovation provides schools with access to technology, yet it is still unknown whether this proximity to funding and resources permits AI to bridge disparities within the state. In other words, will disparities continue despite AI and to what point is providing technology enough?

Indeed, AI is becoming more embedded into every part of work that used to be inherently human, even in education. For instance, teachers are responsible for providing children with the foundational knowledge necessary to succeed, especially in elementary school. Since AI may be a tool, it is not useful to be completely apprehensive about AI as many may see it as the future. If implemented evenly, AI might be helpful in closing learning gaps and help guide instructional

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[16] Governor of California, "Governor Newsom Signs SB 53"

[17] Berman and Addis, "AB 2876."

[18] Becker et al., "SB 1288."

teaching for inexperienced teachers. Nevertheless, there are negative effects that should be explored and mitigated first.

Classroom Inequalities: From the Calculator to AI Tools

Inequalities in the classroom have long persisted, especially in unequal access to a new educational technology or tool. According to educators at the time, when graphing calculators were introduced, private schools and affluent students secured their own calculator at around $100 while the price left many low-income students at a disadvantage. Nora Sabelli, a Senior Program Director for Research on Education, Policy, and Practice, remarked that hardware is not the only problem to address when modern technology enters the scene, but so is ensuring "well-prepared teachers and software"[19]. There is a lesson that can be drawn between calculators and AI tools. Both are technological innovations that remain inaccessible to certain schools. Drawing back to Sabelli's statement, providing school resources or funding to access resources is simply not enough. There are factors that affect the overall efficacy of implementing educational tools. For one, even when teachers have access to resources, there is still a question of whether teachers and students have the knowledge to use them.

The moral of the story behind graphing calculators is that there are three barriers to new technology in education that must be addressed in order to achieve equitable outcomes: (1) Closing the resource and funding gap between Low SES schools and High SES schools (2) Providing instructional training to teachers and students on how to use tool (i.e. AI literacy), and (3) Building the necessary infrastructure needed to support AI usage in every classroom.

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[19] Lee, "A Question of Equality"(1999)

The Beginning of Education Technology: Origin of Artificial Intelligence in the Classroom

It is necessary to be aware of the historical context that has contributed to AI's role in education. AI has been underway since the 1920s. It began as an idea that became a tangible vision through developed systems, such as the Programmed Logic for Automated Teaching Operations (PLATO). PLATO was one of the first computer learning systems developed in the 1960s by the University of Illinois as a service for college students to access resources outside of the classroom [20]. Even if PLATO was the first public access to digital learning, it was not the last. Over time, AI evolved into a tool of personalized, adaptive instruction with immediate feedback that could be incorporated into the center of classrooms.

How the Pandemic Helped to Accelerate EdTech and Use of AI in Education

Even when AI's conception is connected to 1920, the COVID pandemic of 2019 is more closely tied to its rapid and widespread use in classrooms. EdTech, or educational technology, was minimally utilized in schools for productivity and learning until online learning began. The pressure to shift education virtually led society to confront the existent achievement gap between communities of different socioeconomic status (SES). The United Nations Educational, Scientific, and Cultural Organization (UNESCO) released a 655-page report claiming that remote learning during the pandemic was an instrument for "a worldwide Ed-Tech tragedy" and "staggering" unequal educational outcomes [21]. The extensiveness of the report provided in-depth reasoning that framed the pandemic's online learning as a mechanism for Ed-Tech's acceleration. In 2021, EdWeek Market Brief reported that an average US school district used "more than 1,449 tech tools" signaling an increase of "52% before the pandemic"[22]. Yet again, the pandemic

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[20] Randhawa and Jackson, "Role of Artificial Intelligence"(2019)

[21] Singer, "Dependence on Tech" (2023, New York Times)

[22] Rauf, "40 Most Widely Used Ed-Tech Products."(2021, Marketbrief)

is strongly correlated to the rise of Ed-Tech and consequently, AI. Following popular trends, such as ChatGPT in 2022, Ed-Tech eventually became integrated with AI [23]. Hence, the battle of the Ed-Tech tools begins.

The proliferation of Ed-Tech tools and AI integration effectively commercialized education as a lucrative market. The expansion of EdTech and AI startups began to exert controls on the instructional material of public schools, which noticeably shifted the mission of education to be driven for profit rather than pedagogical moral interest. In fact, MIT Technology Review reports on educational technology companies aggressively marketing AI to educators. In response, educators advocate for AI's use in their school district to assign tedious responsibilities like lesson planning and grading [24]. A competitive market of hybrid AI Ed-Tech tools competing for their adoption in schools is creating an environment that encourages an over-reliance on tools in an unregulated field carrying its own risks in bias and data privacy.

In the aftermath of California AI Education Policy, we still do not know the extent to which AI has integrated into the curriculum of each school district and if teachers are receiving professional development for AI in education. There has also been no consideration on the effects of open access ChatGPT after its introduction in 2022. Based on the implications AI has on teachers and students in low-income schools, I will explore whether a path towards equity is possible with AI.

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[23] Slagg, "AI in education in 2024" (2024)

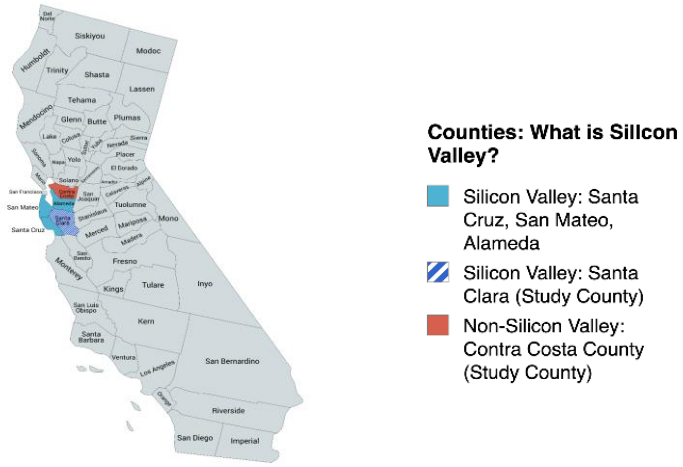
[24] O'Donnell, "How Ed-Tech Companies Are Pitching AI" (2024, MIT Technology Review)

II. Methodology

Research Question

Although Trump's Executive Order serves as the premise of my essay, the policy itself will be the state policy that California enacts, especially when implementation differs by district and school. Within each classroom, the teacher adapts to state and district standards in many ways. The three main districts I compared were Antioch Unified District, Pittsburg Unified District, and the Palo Alto Unified District. All districts are near each other and Silicon Valley [25].

Fig. 5. Medina, Marlene. What is Silicon Valley, 2025? Adapted from Segal 2025 [25]. Map. Mapchart.net



One of the districts is my hometown but selecting California as a case study state goes beyond sentimentalism. According to the Public Policy Institute of California, "in 2023, families at the top of the income distribution—the 90th percentile—earned 11 times more than families at the 10th percentile ($336,000 vs. $30,000, respectively)." [26]. I chose California due to its high-income inequality, but central proximity to the epicenter of AI innovation: Silicon Valley. All school districts have high proximity to AI developers. Moreover, due to their close distance to

[25] Segal, "Sillicon Valley."(2023)

[26] Thorman, Payares-Montoya, and Herrera, "Income Inequality in California"

each other, it minimizes confounding variables related to the environment. I aim to answer three questions: (1) is there an inequality in how AI is implemented within a classroom due to differing socioeconomic status? (2) Is there a change in educational outcomes due to AI? and (3) will inequalities persist despite AI policy implementation in classrooms?

Methods: Data Collection

My first phase of gathering evidence involved conversations with higher education professors to gain insight on their perspectives on AI in education. The second phase included discussions with teachers to learn more about their day-to-day experiences with AI and students. Finally, I analyzed student outcomes within a district and compared district by district. I interpreted this data knowledge into real social realities within schools regarding professional development and current school conditions. Thereafter, after considering the effects AI has on students and teachers, I built a conclusion on AI's effectiveness on achieving equity and the current barriers preventing equitable outcomes in education.

Qualitative Study

I notified participants that most of their answers and opinions would remain private and confidential. To create an open space for discussion, I also offered the option to remain anonymous. Additionally, in respect of privacy, I made each teachers' school and district anonymous. The data collected is qualitative, and it is founded on 5 brief questions tailored to the selected participant (See Appendix A: Forms 1-2). The questions for a professor are built to express opinion and prediction on AI, but for a teacher, they are built to explain experience.

To begin, I held discussions with University of Chicago professors to discover their professional perspective on AI tools used in K-12 education and the impact it has on university students today. I spoke with Professor Rosen, Professor Keels, and Professor M (an anonymous

source from the Comparative Human Development Department). The second set of discussions was with teachers. The first source is a first-grade teacher in California, Mrs. Trujillo. The second data source is a fifth-grade teacher in California, Mrs. Diaz. The third source is a middle school teacher and counselor for a school in Mexico bordering the United States. To conceptualize the full scope of AI's reach, I decided to talk with someone who could provide a unique perspective on AI's international development and expansion in education.

Quantitative Study

I sought to understand the current district and school conditions before tracking changes over time. The focus is on elementary schools due to their foundational nature for higher grades. The data sets I used to report on demographics and student outcomes were obtained from the California Department of Education (CDE) using the California School Dashboard Report and the California Assessment of Student Performance and Progress (CAASP). I chose schools within each district by considering the average percent of socioeconomically disadvantaged students for every school within each district for 2024-2025 using the Dashboard Report. Within each district, I chose one school with the highest poverty index, one school with the lowest poverty index, and another school that could serve as the intermediate between the two (See Appendix B, B3).

(1) In Palo Alto Unified District, there is a low poverty index. The school representing the highest index is Barron Park Elementary, and the lowest index is Lucille M Nixon. The intermediate school between the two is Duveneck Elementary[27].

[27] California Department of Education. *California School Dashboard*. Sacramento, CA: CDE, 2024.

(2) In Antioch Unified District, there is a higher quantity of elementary schools and a higher index of poverty. The school representing the highest index is Kimball Elementary, and the lowest index is Diablo Vista Elementary. The intermediate is Fremont Elementary[28].

(3) In Pittsburg Unified District, there are fewer elementary schools, but a more evenly distributed high index of poverty. The school with the highest index is Parkside Elementary, and the lowest index is Foothill Elementary. The intermediate school between the two is Willow Cove Elementary[29].

After I reported on current school conditions, I also gave a report on student achievement in ELA and Math in response to unrestricted access ChatGPT in 2022 and socioeconomic disadvantage using a longitudinal study of schools from 2018-2025. There will be two sets of regressions: (1) Per District Change Over Time in ELA/ Math (2) District- by- District Change Over Time. There will be 8 regressions. The dependent variables are ELA and Math Scores while the independent variables or control variables are AI effects and socioeconomic disadvantages. Post AI effects refer to the presence of direct access AI influence following the release of ChatGPT in 2022 represented by a 0 for no effect and 1 for effect. 2018-2022 will represent no effect (0) while 2023 and 2024 will represent an effect (1).

Methods: Data Analysis

The main tool used was Excel to create datasets from online reports. All the graphs and tables were made in Excel. However, to make the regressions, I utilized R Studio using the master dataset I made to measure SES, AI Access, and Achievement Scores in ELA and Math

[28] California Department of Education. *California School Dashboard*. Sacramento, CA: CDE, 2024.
[29] California Department of Education. *California School Dashboard*. Sacramento, CA: CDE, 2024.

over time. Before conducting regressions, I considered each School Accountability Report Card (SARC's) to consider each school's current conditions in facility conditions, total expenditure per pupil, professional development days, socioeconomic disadvantage, racial/ethnic distribution, and respective stance on AI. I wanted to create a comprehensive exploration of each district and respective school in the present before looking at the change that has occurred over time.

Before regressions, I graphed District Outcomes for the Selected Schools and cumulative ELA and Math results over time for all district schools to fully understand the dynamics within schools. I analyzed the achievement of elementary schools since these years are foundational to a student's educational trajectory.

To increase the statistical power of my predictions, I included all the elementary schools for each district and the cumulative achievement for all grades to test the performances of schools. The regressions I made were based on the following equations to test the per district change and district by district comparison for ELA and math totaling into 8 regressions. I included 8 models to account for (1) ELA in Antioch District, (2)Math in Antioch District, (3) ELA in Pittsburg District, (4) Math in Pittsburg District, (5) ELA in Palo Alto District, (6) Math in Palo District, (7) ELA Achievement Comparison, (8) Math Achievement Comparison. The first 6 regressions are focused on each individual district's relationship to ELA and Math. The last 2 regressions focus on a district-by-district comparison using Palo Alto as a baseline to compare the other two districts.

Equation 1: Per District Change Over Time

$$ELAmetstandardscores = \beta_0 + \beta_1 PostAI + \beta_2 Disadvantage$$

$$Mathmetstandardscores = \beta_0 + \beta_1 PostAI + \beta_2 Disadvantage$$

Equation 2: District by District Comparison Over Time

$$ELAmet_{it} = \beta_0 + \beta_1 PostAI_t + \beta_2 Antioch_i + \beta_3 Pittsburg_i + \beta_4 (PostAI_t \times Antioch_i) + \beta_5 (PostAI_t \times Pittsburg_i) + \beta_6 SocioeconDis + \epsilon_{it}$$

$$Mathmet_{it} = \beta_0 + \beta_1 PostAI_t + \beta_2 Antioch_i + \beta_3 Pittsburg_i + \beta_4 (PostAI_t \times Antioch_i) + \beta_5 (PostAI_t \times Pittsburg_i) + \beta_6 SocioeconDis + \epsilon_{it}$$

I repeated the process in a second round of regressions to standardize my values and add control factors, such as chronic absenteeism and suspension rates, to see if these factors also played a role in school dynamics.

Limitations

(1) The time allotted for research was significantly reduced. The time constraint was two months, so I was only able to recruit 2 teachers from only the low SES district(s). If there was more time to follow up, I would expand my research by interviewing teachers from each district and more schools. An increased number of teacher interviews would have provided a stronger depth to my findings and insight into the specific ways schools deviate from district policy and state standards.

(2) The pandemic reduced the longitudinal study to include only the last five years. The significant years of 2019 and 2020 cannot be found in the data because they are omitted from the public. The missing two years of data and tracked academic performance create a gap in accounting for changes. Therefore, more work must be done to study AI's effects

effectively and isolate is effects from the pandemic since most outcomes are correlated to the outcomes seen in the data and regressions.

(3) The recent AI policy may not have observable changes yet. California has passed bills only for safety and accountability in 2024, but not widespread implementation. Therefore, AI implementation is sparse and not state mandated. The critique on California AI education policy only rests on the policy taken by each district within California and not California itself.

III. Findings: Public Opinion in Academia

Professor Interviews: High Academia Opinion and Predictions

The consensus on AI was displayed with a hint of caution and a flicker of hope. Speaking with University of Chicago professors on campus, I was able to perceive the hesitancy to outright condemn AI since it was seen as the inevitable future. There were three prominent points that were relevant to the discussion of AI in classrooms. First, although AI provides supplemental support, it should not be taken as a supplement to critical thinking. Second, some schools and students may be left out or unprepared to take on tools due to a lack of resources and support. Lastly, AI platforms should have the appropriate guardrails in place to protect children from bias and violation of privacy.

Dr. Lisa Rosen, the Executive Director of Science of Reading at the University of Chicago, cultural anthropologist, and expert on educational policy, related experiences with students entering with an increasingly dependent relationship with AI. As I entered Professor Rosen's office for an interview, she voiced her concern with AI's direct access to children in a K-12 environment, especially in early schooling before children have "developed foundational, critical thinking skills, communication, and analysis skills". Therefore, she suggested subject

area experts and teachers should have a hand in designing AI tools that are "integrated into curriculum in a thoughtful manner" to reflect the "best practices of pedagogy and child development." This recommendation reflects the concern over the bias and harmful content AI can present if schools are not enforcing regulation and neglecting to teach AI literacy courses on the information generated by artificial intelligence systems.

Dr. Micere Keels, Policy and Practice Leader for North Carolina Early Childhood Foundation and Founding Director of Trauma Responses Educational Practices (TREP) Project, discussed the scalability of AI education. She related her individual experiences to schools and how "none of the schools" she has worked in have AI integrated into their educational curriculum. Moreover, Professor Keels expressed the danger of assuming all schools have the resources and professional development support needed to kickstart AI in education since "not all schools have computers for every student." Every district and school within a state lives in a different context, whether its divergence in digital access, socioeconomic status, or degree of "urbanicity." Rural schools may struggle to gain access to AI partnerships or may face unique challenges compared to schools in urban areas. The different contexts in which schools find themselves can create a potential gap in AI use and implementation per classroom.

A professor from the Department of Comparative Human Development, who requested anonymity referred to as "Professor M" expressed deep concern. They mentioned how AI, as a new tool, should not be open to access to impressionable children before we know its effects and mitigate its bias. As AI is embraced as a tool to close gaps, Professor M raised the fact that these machines are fed with normative concerns creating a biased platform being taught to students. Overall, the learning driven by AI may "shape dominant perspectives" and may cause "less interpersonal interactions with students, peers, and teachers". AI generates its outputs through

the outputs it is given. Therefore, chatbots or language learning models (LLMs) used in tools would provide a one-dimensional view of learning lacking complexity. Even when AI has the potential for good, it is also necessary to be wary of the emerging negative implications on teachers and students.

IV. Findings: Implications on Teachers

Fig.6.Kenny Eliason, Classroom Sitting Down to Learn, 2017. Photograph. Unsplash.

What is it like to be a teacher? On a regular day, a teacher faces pressures in a job that truly never ends, which follows them from school to home. 17 unread emails, the pressure from administration to prepare students even with limited resources, and a crowded classroom of students with diverse learning needs. The classroom buzzing with sound awaits instructions looking at a teacher with expectant eyes. A teacher, stressed with the demands of district and state standards, hopes to engage students to learn. That is only a short glimpse of the pressures teachers face that may naturally accumulate in chronic stress for educators.

In 2025, researchers at the University of Missouri found that 78% of 500 public school K-12 teachers have thought about quitting their profession due to a lack of administrative support, excessive workload, inadequate compensation, and challenging behaviors from students[30]. Teachers must play multiple roles beyond an instructor: a caregiver, mentor, and innovator. The many hats' teachers wear must accumulate into a state of teacher burnout that goes uncontrolled without the necessary support. AI in education seems to be a lifeline for educators who do not find the same support in their schools and require assistance.

Educator Experiences with AI

Mrs. Trujillo, a first-grade teacher, minimally uses AI, but she has succumbed to the pressures. She prides herself on her minimal use, but she admits that her transition to AI has made her life easier. Indeed, she recounts how digital and computer activities powered by Ed-tech powered AI systems are "not really exciting" for students who view these activities as normalized since the pandemic. Mrs. Trujillo shared an enthusiasm for AI's integration into education for making the act of teaching less challenging through its assistance on simple lesson planning, grading, and notes. However, she also emphasized preserving the human role in teaching. The connection between teachers built with students is important to optimize learning and a key part of keeping students engaged. A computer or AI for that matter cannot replicate the social bond and support children need to feel motivated to reach their goals.

Ms. Diaz, a fifth-grade teacher, presented a diagram along with four expressions. Students perplexed had to choose one of the expressions that explained the diagram. Ms. Diaz confirms that students are engaged and know the answer, but they do not know why the answer

[30] Stann, "Study Reveals Why Teachers Are Leaving."

is the way it is. As a bilingual educator teaching dual language immersion, Ms. Diaz attended the California Association for Bilingual Education (CABE), which warned educators about the dangers of free AI tools offered that can easily steal student data and violate privacy. Ms. Diaz sees AI in education as something positive, but she mentioned how the lack of professional development for integrating AI into the classroom leaves teachers with little to no guidance. Moreover, she expressed difficulty due to her district's limited resources causing her to plead to fix necessary tools like her ELMO, a projector for presenting problems. The emergence of an AI achievement gap is possible, especially when Ms. Diaz voiced her care for students not having the same opportunities as other schools:

> I wish we had more for them. I wish I were taught about these things, so it could be easier for me. Our school has limited resources. Other schools have smart screens and available computers. I wish we had that

Even when the study on AI in education focuses mostly on US standards and values, it is necessary to recognize the international arms race competition occurring in technology. To expand the understanding of AI's infiltration into society, I explored beyond the boundaries of the United States to our closest neighbor: Mexico. Mrs. Delfin, an educational professional in a middle school in Mexico, reports she has not witnessed the use of AI in education. The students at her school are exposed to no Wi-Fi zone, which has limited students' access to phones and tools. AI exposure is shifted mostly to memes on social media and as an instrument potentially used for negative outcomes online, such as cyber-bullying. Mrs. Delfin explained how she perceived AI:

> A double-edged sword. It can be used for good and for bad, much more for bad at this moment. Of course, this tool will not substitute a teacher, so it can be a benefit or a disadvantage if teachers are not trained to avoid mistakes or create bad actors.

V. Implications on Students

Fig.6. Haseeb Modi, Classroom Sitting Down to Learn, 2024. Photograph. Unsplash.

An Understanding of Demographics and Socioeconomic Status

Both Contra Costa County and Santa Clara are about 40% Hispanic, reflective of the Statewide average (56.1%) clearly indicating Hispanic students are the majority in California's 5.8 million student population. Looking deeper, Contra Costa County is mostly Hispanic and White, but the selected schools reflect a concentration of racial minorities. In the same vein, Santa Clara County has a large share of Hispanic (40.5%) and Asian students (30.8%) that outnumber White students in total. However, the selected Palo Alto schools shown in are racially disproportionate to the County since they serve primarily Asian and White students as opposed to Hispanic students who only make up 20% of the student body. On top of that, African

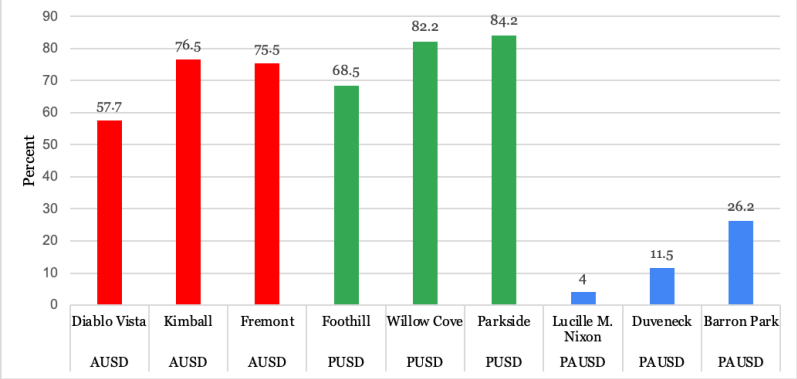
American students are not only a minority in the county, but also a minority in Palo Alto schools (1.6%) lower than the state average (See Appendix B1-B2, B4)[31].

The racial demographic patterns are severely disproportionate, implying a racialized distribution across district and selected schools. When looking closely at the districts to examine the racial nuances of all schools, there is a confirmed trend occurring. Antioch (50.7%) and Pittsburg (66%) indeed serve more Hispanic students than Palo Alto (15.70%). Moreover, the amount of African American students served in Palo Alto is lower (1.80%) than in Pittsburg (15.40%) and Antioch (23.30%). Antioch and Pittsburg serve more Hispanic and African American students. On the other hand, Palo Alto serves more White (28.9%) and Asian (40.5%) students (See Appendix B1-B2-B4)[32].

As shown in Figure 7, most of the students attending the selected schools within Antioch and Pittsburg districts hold a higher disadvantage (58-84%) compared to the lower disadvantage (4-26%) within Palo Alto (PAUSD) selected schools. Antioch (AUSD) and Pittsburg (PUSD) school districts serve more minority students, but those said students also have a higher socioeconomic disadvantage.

[31] California Department of Education. Enrollment by Ethnicity. Data from Antioch, Pittsburg, and Palo Alto district
[32] California Department of Education. Enrollment by Ethnicity. Data from Antioch, Pittsburg, and Palo Alto district

Figure 7: 2023-24 Percent of Students Who are Socioeconomically Disadvantaged in Antioch Unified District, Pittsburg Unified District, Palo Alto Unified District



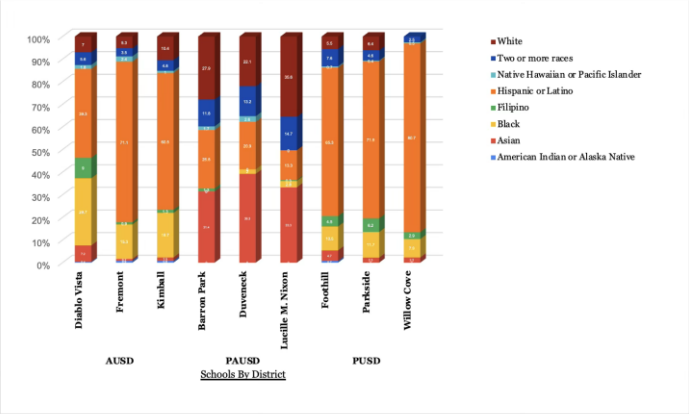
Adapted from California School Dashboard

Racial Segregation and Resource Disparities

Beyond the averages from selected schools, we observe the segregative dynamics occurring in Figure 8. The racial disproportionality is also tied to the socioeconomic disadvantage as discussed. Antioch (AUSD) and Pittsburg (PUSD) school districts serve more minority students, but those said students also have a higher socioeconomic disadvantage.

Figure 8: 2023- 24 Racial/Ethnic CompositionWithin Each District

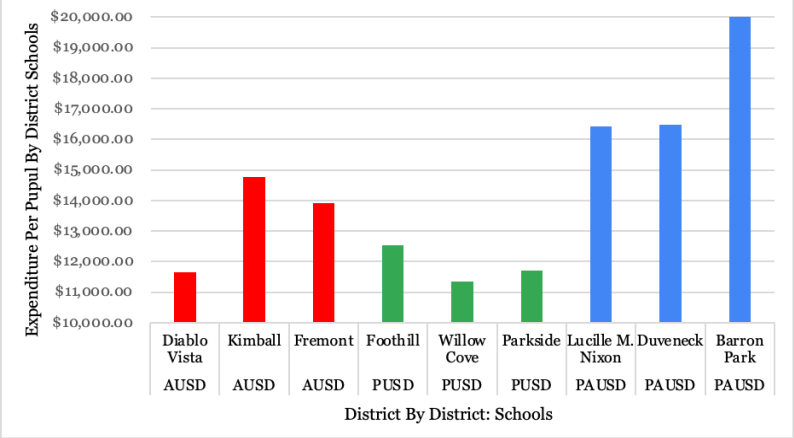
Selected School: Antioch Unified District, Palo Alto Unified District, Pittsburg Unified District



Adapted from California School Dashboard

One might say that due to the higher number of minority and disadvantaged students, the districts of Antioch and Pittsburg would deserve more funding. However, reality is bleak. Despite the great need for funding, Figure 9 demonstrates that Palo Alto, a district with less disadvantaged and minority students, has more total expenditure per pupil. The lowest funded schools in Antioch and Pittsburg invest about $11,000 per pupil while the lowest funded school still provides a per pupil expenditure of about $16,000. Even though the difference between both is about $5,000, any amount of financial investment is crucial for providing every student with the resources needed to succeed. The graph implies a current condition of inequity between school districts who may not have the same access to educational opportunities as wealthier districts. Thus, there is structural inequality that favors White and Asian students more than African American and Latino students. In Pittsburg and Antioch, there is not only a higher number of disadvantaged and minority students, but there is less funding for schools.

Figure 9: 2023-24 Total Expenditure Per Pupil By District Schools in Antioch, Pittsburg, and Palo Alto [31]



Adapted from School Accountability Report Cards (SARCs)

According to SARC report cards in California grading facilities, every selected school for Palo Alto Unified District is given a rating of "exemplary," while Pittsburg and Antioch schools

are only given a rating of "good" or "fair." PAUSD omitted notes on their facility features, but AUSD schools shared the inspector's comments. The notes signaled "large cracks, potholes, broken drainpipes, exposed wires, missing ceiling tiles and conduits, mold growth, and dry rot" in Kimball Elementary, but the trends were also similar in the other selected schools even in Diablo Vista which is the least disadvantaged school in the district [33]. Therefore, the gaps in funding also translate into lower quality within schools that serve socioeconomically disadvantaged students.

Socioeconomic Disadvantage and Lower Performance in ELA and Math Achievement

Does the level of disadvantage reflect test scores? The answer is yes. The CAASP test scores in ELA and Math for 2023-2024 [34] for each district selected schools reveal a negative

[33] California Department of Education, *School Accountability Report Card* (Kimball Elementary data), accessed November 2025, https://www.antiochschools.net/page/school-accountability-report-cards; California Department of Education, *School Accountability Report Card* (Fremont Elementary data), accessed December 6, 2025, https://www.antiochschools.net/page/school-accountability-report-cards; California Department of Education, *School Accountability Report Card* (Diablo Vista Elementary data), accessed December 6, 2025, https://www.antiochschools.net/page/school-accountability-report-cards; California Department of Education, *School Accountability Report Card* (Willow Cove Elementary data), accessed December 6, 2025, https://pittsburgusd.net/Departments/Educational-Services/Educational-Services-Home/SARC-OVERVIEW/index.html; California Department of Education, *School Accountability Report Card* (Parkside Elementary data), accessed December 6, 2025, https://pittsburgusd.net/Departments/Educational-Services/Educational-Services-Home/SARC-OVERVIEW/index.html; California Department of Education, *School Accountability Report Card* (Willow Cove Elementary data), accessed December 6, 2025, https://pittsburgusd.net/Departments/Educational-Services/Educational-Services-Home/SARC-OVERVIEW/index.html.

[34] California Department of Education, *CAASPP Dashboard View Report SB* (Diablo Vista Elementary School, Antioch Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=07&lstDistrict=61648-000&lstSchool=6117501; California Department of Education, *CAASPP Dashboard View Report SB* (Fremont Elementary School, Antioch Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=07&lstDistrict=61648-000&lstSchool=6003594; California Department of Education, *CAASPP Dashboard View Report SB* (Willow Cove Elementary School, Pittsburg Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=07&lstDistrict=61788-000&lstSchool=6004576; California Department of Education, *CAASPP Dashboard View Report SB* (Parkside Elementary School, Pittsburg Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=07&lstDistrict=61788-000&lstSchool=6004568; California Department of Education, *CAASPP Dashboard View Report SB* (Village Elementary School, Pittsburg Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=07&lstDistrict=61788-000&lstSchool=6098578; California Department of Education, *CAASPP Dashboard View Report SB* (Fairmeadow Elementary School, Palo Alto Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=43&lstDistrict=69641-000&lstSchool=6068241; California Department of Education, *CAASPP Dashboard View Report SB* (Hoover Elementary School, Palo Alto Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=43&lstDistrict=69641-000&lstSchool=6048292; California Department of Education, *CAASPP Dashboard View Report SB* (Juana Briones Elementary School, Palo Alto Unified, 2025), https://caaspp-elpac.ets.org/caaspp/DashViewReportSB?ps=true&lstTestYear=2025&lstTestType=B&lstGroup=1&lstSubGroup=1&lstGrade=13&lstSchoolType=A&lstCounty=43&lstDistrict=69641-000&lstSchool=6115562.

correlation between level of socioeconomic disadvantage and test score meaning that as the percentage of disadvantage increases, the test scores also tend to decrease [35](See Appendix C). Palo Alto schools have lower disadvantages but also tend to have higher test scores both in ELA and Math. Exhibiting a similar trend, Antioch and Pittsburg have a higher socioeconomic disadvantage associated with lower test scores in ELA and Math. Although correlation does not equal causation, this suggests there may be underlying disparities in how resources are distributed especially among schools that are not only disadvantaged but have a higher concentration of Latino and Black students.

District AI Policy and Professional Development

The inequalities in infrastructure create an environment unprepared to sustain the implementation of AI-powered classrooms. Again, there is little to no AI professional development available in lower SES schools. On the other end of the spectrum, Palo Alto has a clear, centralized AI district policy. Palo Alto district permits access, guidance and support to teachers and students through an accessible guidebook and "Lunch and Learn" initiatives[36]. Moreover, Palo Alto has adopted a district-wide partnership with Google Gemini for all students and teachers[37].

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[35] California Department of Education, *California School Dashboard: Summary* (Fremont Elementary School, Antioch Unified, 2025), https://www.caschooldashboard.org/reports/07616486003594/2025; California Department of Education, *California School Dashboard: Summary* (Kimball Elementary School, Antioch Unified, 2025), https://www.caschooldashboard.org/reports/07616486003602/2025; California Department of Education, *California School Dashboard: Summary* (Diablo Vista Elementary School, Antioch Unified, 2025), https://www.caschooldashboard.org/reports/07616486117501/2025; California Department of Education, *California School Dashboard: Summary* (Willow Cove Elementary School, Pittsburg Unified, 2025), https://www.caschooldashboard.org/reports/07617886004576/2025; California Department of Education, *California School Dashboard: Summary* (Parkside Elementary School, Pittsburg Unified, 2025), https://www.caschooldashboard.org/reports/07617886004568/2025; California Department of Education, *California School Dashboard: Summary* (Village Elementary School, Pittsburg Unified, 2025), https://www.caschooldashboard.org/reports/07617886098578/2025; California Department of Education, *California School Dashboard: Summary* (Fairmeadow Elementary School, Palo Alto Unified, 2025), https://www.caschooldashboard.org/reports/43696416068241/2025; California Department of Education, *California School Dashboard: Summary* (Juana Briones Elementary School, Palo Alto Unified, 2025), https://www.caschooldashboard.org/reports/43696416115562/2025; California Department of Education, *California School Dashboard: Summary* (Hoover Elementary School, Palo Alto Unified, 2025), https://www.caschooldashboard.org/reports/43696416048292/2025

[36] Palo Alto Unified School District, "Technology/AI Resources."

[37] Concolato,"AI is now available to all students"

Pittsburg District acknowledges their use of AI but according to one of their teachers they do not have "AI professional development" leaving them in an environment that can only be described as a Wild West Environment where educators may choose to use AI tools at their own discretion. Antioch District mentions AI in the context of apps that school employees are allowed to choose tools with "professional development" to assist in "developing syllabi, creating curriculum, reviewing student work, suggesting instructional strategies, and researching academic content or instructional techniques."[38]

The use of AI is gatekept by teachers in Pittsburg and Antioch district schools. However, Antioch differs from Pittsburg according to their mention of AI app use professional development according to tools teachers can use at their own discretion[39]. Despite this minor difference, Palo Alto Unified District has an AI centralized instruction system that not only provides guidance and professional development for teachers but also enforces an AI curriculum and literacy course for students to openly use artificial intelligence. Regular professional development days also differ by district. For example, Antioch and Pittsburg have 3 professional development days on average while Palo Alto has quadruple that amount through an average of 12 professional development days [40]. As a result, Palo Alto provides more support to teachers and a democratization of AI use for teachers and students.

Regression

Based on the data analysis of regressions I conducted, the socioeconomic disadvantage is the strongest predictor among all variables. The first round of regressions portrayed the effects of

[38] Antioch Unified School District, "All Personnel BP 4040."

[39] "BP4040 ACCEPTABLE USE AGREEMENT and RELEASE of DISTRICT from LIABILITY (EMPLOYEES)" 2025

[40] California Department of Education, *School Accountability Report Cards.*

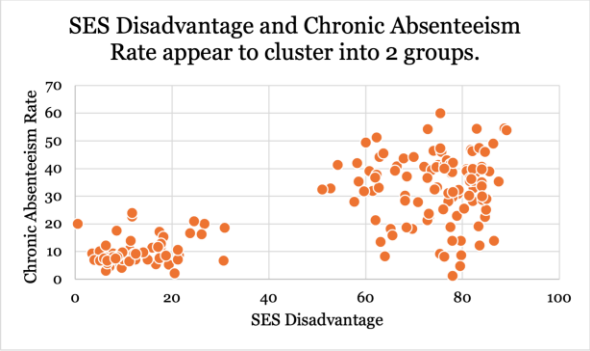
AI access and SES on ELA and Math achievement over time by district and district comparisons. Meanwhile, the second round was a pooled comparison that also considered chronic absenteeism and suspension rate. In both rounds, socioeconomic disadvantage is the most significant variable. However, AI access showed minimal effects with no statistical significance.

Year

From 2018-2014, the yearly change for ELA and Math achievement was tracked for all models of districts. In Antioch, the school year is marginally significant to significant to the lower ELA (-1.14) and math achievement (-0.967) observed. In Pittsburg, it is marginally significant to significantly lower ELA achievement (-1.7) and math achievement (-1.47). In Palo Alto, the yearly changes per year are not significant, and do not change dramatically. Overall, Antioch and Pittsburg schools in comparison to Palo Alto schools have lower achievement per year in ELA (-0.658) and math (-0.853). Antioch, in comparison to the two other districts, has lower achievement in ELA (-24.893) and math (-33.253). Pittsburg, in comparison to the other two districts, has lower achievement in ELA (-17.937) and math (-27.521) as well. (See Appendix B5-B6)

Chronic Absenteeism

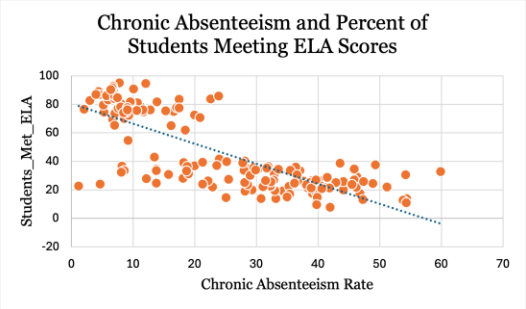
Figure 10



Adapted from California Dashboard Report 2019-2025

The chronic absenteeism rate was observed in the second round of regressions, considering pooled comparisons. Chronic absenteeism did not have a significant effect on achievement of performance in each district. Chronic absenteeism had a marginal effect on Antioch district ELA achievement, causing lower scores (-4.782). Chronic Absenteeism is more common in schools with a higher disadvantage. The correlation chart shows up as two separate clusters, and those schools with a lower socioeconomic disadvantage seem to also have a low absenteeism rate compared to the higher socioeconomic disadvantage cluster group. Chronic absenteeism also negatively affects the percentage of students who meet ELA standards. (See Appendix B6)

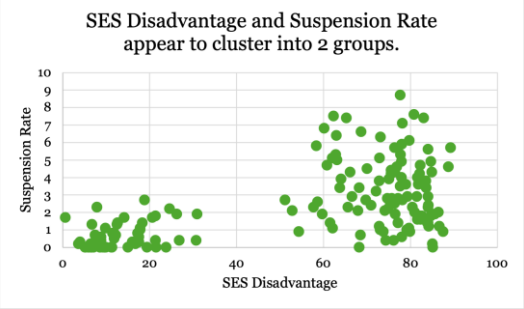
Figure 11



Adapted from California Dashboard Report 2019-2025

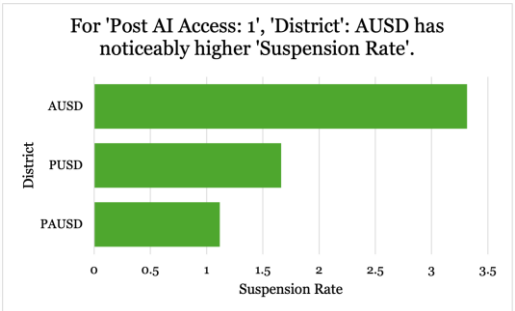
Suspension

Figure 12



Adapted from CDE

Figure 13



Adapted from CDE

The suspension rate was seen in the second round of regressions, considering pooled comparisons. Suspension had a marginal effect on Antioch district math achievement (-1.579) and significant effects on Palo Alto ELA (-4.94) and math achievement (-4.753) causing lower student performance. In fact, schools with higher SES disadvantage schools tend to have higher suspension rates, which may also disrupt learning and contribute to a negative school environment. One noteworthy observation is that this year's post ChatGPT introduction; suspension rates of Antioch have higher suspension rates compared to the other two districts. However, these new effects may exist as a function of alternative out-of-school factors. (See Appendix B6)

AI Access

AI access across all districts is not statistically significant for any of the models. The AI access variable only accounts for the existence and perceived influence of ChatGPT following its release in 2022. I observed AI effects and its effects on districts for ELA and math achievement, but the coefficients were small and not significant. Once SES disadvantages and districts are controlled, AI access has no measurable effect over time during the period of 2018-2024. The results for the first round of regressions focus primarily on AI Access and socioeconomic disadvantages. In Antioch, access to AI is associated with 1.5% higher achievement in ELA and 2.5% higher achievement in math. In Pittsburg, AI is associated with 5% higher achievement in ELA and math. In Palo Alto, AI access is associated with 2% lower achievement in ELA and 0.8% higher achievement in math. Even if AI effects on performance exist, the results are not significant statistically since it does not account for the variance in usage for every student, its current implementation in schools, and the effective of teacher's use of AI. These metrics for AI are needed to measure the effects of AI on student achievement, but they do not exist yet.

In the second round of regressions with pooled comparisons, I accounted for other factors, such as suspension rate and chronic absenteeism rate. Like the first round, none of the models demonstrated that AI access is a significant predictor of student achievement in schools due to its statistical insignificance. AI access demonstrates minimally 1.9% lower achievement in Antioch District ELA and 0.8% lower achievement in Palo Alto District ELA. The rest of the scores for ELA and Math achievement are minimal improvements, but none of them are statistically significant. Therefore, AI unrestricted access does not cause a notable change in the ELA and math achievement for Antioch, Palo Alto, and Pittsburg districts from 2018 to 2024. There may be more measurable effects if there were AI metrics that measured the AI usage of students and teachers. Many AI effects may be hidden due to the discreet use of AI by students and teachers as well as many other factors that may contribute to achievement significantly more. (See Appendix B5-B6)

Socioeconomic Disadvantage

Controlling district, AI access, and year establishes socioeconomic disadvantages as a highly significant predictor of ELA (-0.494) and math achievement (-0.495) in the first round of regressions. In the second round of regressions with pooled comparisons, SES disadvantage is shown to have even larger effects. In Antioch, socioeconomic disadvantage predicts lower ELA and math achievement by about 11 percent. In Pittsburg, socioeconomic disadvantages hold only marginal significance and not statistical significance. However, the projection of ELA achievement and Math achievement is also negative corresponding to lower scores in response to socioeconomic disadvantages. In Palo Alto, socioeconomic disadvantage is significant to lower ELA achievement by about 21 percent and math achievement by about 25 percent. Therefore, the socioeconomic disadvantage is a useful predictor of achievement. (See Appendix B5-B6)

VI. Analysis: Implications on Equity

The goal of education is equity, but to understand this concept, it is necessary to provide a definition. Educational equity refers to ensuring that "every child receives what they need to develop their potential" [41]. After reviewing the existent segregation between schools and the level of socioeconomic disadvantaged students concentrated in schools with more racial and ethnic minorities, there is a common thread of systemic inequality that contributes to educational inequality. The conditions of schools are not the same. Schools with a high percentage of socioeconomically disadvantaged and minority students have less per pupil funding and lower quality school facilities. This disadvantage in resources prevents effective AI implementation since schools have a pre-determined list of priorities to improve schools that come before AI due to the pre-existing inequality in resources. Therefore, despite AI implementation, the pre-constructed inequalities that exist between low SES schools and high SES schools will be hard to close since academic achievements are not the only disparity.

Each district has their own AI policy; Palo Alto district schools consistently outperform Pittsburg and Antioch District schools. Palo Alto District in 2025 confirmed a partnership with Google Gemini to provide access to teachers and students. Beyond the 12 professional development days, teachers have access to "Lunch and Learn" guidance on AI. On the other hand, Antioch and Pittsburg district schools allow teachers to use AI schools but lack a centralized system of Artificial intelligence and a democratized direct access to both students and teachers. Although both rounds of regression established that the existence of direct access to ChatGPT AI had no relationship to ELA and math achievement, there is an inability to truly measure the effects of AI due to the absence of metrics.

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[41] National Equity Project, "Educational Equity Definition"(2023)

Before diving into research on teacher experiences and student outcomes due to AI, I had a conversation with professors at the University of Chicago, who informed me of my research. Although I requested interviews, the purpose was to gain more knowledge and understanding on the topic beforehand through a regular discussion guided by a framework of questions. All three of the professors had a special interest in education, so their expertise served as the opinions present in high academia and research. The main concerns lie on the loss of critical thinking, concerns inequality, and a necessity for guidance and regulations on AI if it were to be integrated in education for elementary-age children. Professor Rosen discussed the unequal access to technological tools and the dangers of applying AI without roots in evidence-based pedagogy. Professor Keels referred to the unequal infrastructure and system conditions in schools that are not conducive to AI learning and would hinder effective implementation if professional development and support is not provided. Moreover, Professor M from the Department of Comparative Human Development worried that children's development would change in response to AI, which is a normative, biased platform that may exacerbate negative outcomes if not mitigated.

One thing is for sure, teachers in K-12 are using Ed-Tech and AI tools. Some teachers may vary in their use of AI depending on their opinions on AI, their workload, or the amount of support they receive. Teachers are susceptible to burnout due to their substantial number of responsibilities that become intensified when their school has limited resources. To many teachers, AI may be a lifeline. Therefore, it becomes paramount to measure the amount of instructional material that is overly reliant on AI and may widen achievement gaps. The teachers interviewed admitted their use of AI and justified their usage by confirming that it made their lives easier. The pressure to use AI may be born from the overwhelming duties a teacher has to

face daily. Despite the use of AI being beneficial to teachers to lessen stress, their state of mind is worried about how students may respond to AI.

Indeed, the existence of direct access to AI ChatGPT did not have a measurable statistical significance on ELA and math achievement outcomes, but socioeconomic disadvantage had a highly meaningful relationship on performance. Therefore, before firmly establishing AI in curricula, there are structural inequalities that must be addressed. For instance, suspension and chronic absenteeism are more widespread in Pittsburg and Antioch schools and had a shown significant negative impact on certain schools' achievement.

VII. Recommendation for Responsible Implementation and Practice

The presence of AI was measured, but the direct effects are unable to be measured with the current public data available. To directly measure the effects of AI, data measuring the usage of AI by students and teachers is necessary. The effects of AI are underestimated by the regressions. Beyond the potential effect of AI on student performance, the gaps between schools continue to persist, and achievement can be effectively predicted according to socioeconomic disadvantages. The period from 2018-2025 demonstrates that achievement in ELA and math have continued to be higher in Palo Alto and lower in Pittsburg and Antioch. In Pittsburg and Antioch schools, the implementation of AI in education according to district guidelines gives the impression of a Wild West environment due to the lack of proper guidance for teachers and implementation of AI in the classroom, which is desperately needed.

The California Department of Education has an optional guideline for schools and teachers on how to best implement AI. (1) AI should support but not replace the role as an educator. (2) The state encourages professional development on how AI works, its benefits and limits, ethical use, bias in AI, and classroom applications (2) AI reveals the current digital gap

and AI gap in use, so it is a school's responsibility to teach AI literacy. (3) It is a teacher's responsibility to safely use AI to protect student data privacy. To ensure all schools are implementing AI equally and prevent further inequalities between schools, it is necessary for schools like Antioch and Pittsburg to have California AI guidelines become required instead of a loosely applied recommendation[42].

As learned by the calculator for example, making sure each student has access to a tablet or device is crucial, but also a surface level solution. It is necessary to provide schools with the support needed to ensure effective implementation. The professional development teachers need goes beyond completing modules or workshops. Teachers need support on how to best use AI in practice rather than in theory for a prolonged period. Again, Antioch and Pittsburg were found to have 3 professional development days in one single school year while Palo Alto has 12 days (about 1 week 10 days). Moreover, teachers in Palo Alto can sign up for "Lunch and Learn" professional development days to learn more about AI and strengthen their current practices. Extra professional development days should be offered in all district schools to those who need extended support.

Professional development days are important for imparting knowledge or the "theory" of how classroom management should happen, but long-term support may call for teacher coaching and mentorship. There is convincing evidence that implies teacher coaching improves instructional practice, student learning, and student achievement when coachers and teachers have defined roles and a relationship of trust[43]. Just as AI provides teachers with immediate feedback on student progress, coaches will provide human oversight to observe and provide

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[42] California Department of Education, "Learning with AI."

[43] Ali, Wahi, and Yamat, "Review of Teacher Coaching"

proper feedback on how to support teacher practices with AI. Moreover, a coach can help a teacher build AI literacy assignments and address the taboo subject of student AI use. However, stakeholders must also assess if their community, in this case school, is ready to adopt innovation since the "organizational structures must support the innovation"[44]. The school itself must be clear about their expectations and any upcoming changes, provide a supportive learning environment for continuous professional development, and provide a comprehensive system of reliable technology infrastructure and tools.

Teachers are also concerned about AI integration into the classroom. Although teachers report feeling relieved at their lives being made easier, they also feel concerned about their students and how they are involved. All the teachers I spoke to wish to have professional development training to use AI more effectively. The urgency to begin implementing AI in Pittsburg and Antioch schools is heightened now that Palo Alto schools have begun implementing AI through their partnership with Google Gemini that is available to students and teachers. Despite the potential for AI to close achievement gaps between low-income and high-income public schools, there is structural patterns of socioeconomic condition that continue to affect the number of students who are chronically absent, suspended, and receive lower achievement in both ELA and math. To address all these existential issues, technology will not be enough.

[44] Ali, Wahi, and Yamat, "Review of Teacher Coaching"

VIII. Discussion

The effects of a student's socioeconomic status may account for many of the effects seen in student performance. In academic circles, professors at the University of Chicago stressed their worry. School teachers within the three districts of Antioch, Pittsburg, and Palo Alto expressed their optimism over AI as a tool that has lessened the load of their responsibilities and has complimented their teaching. However, Ms. Diaz recognized a trend of declining critical thinking skills in her students who were engaged and understood the answer to problems but struggled to give complex analysis and explanations. It has been about 3 years since the release of ChatGPT's unrestricted access AI in 2022 and 6 years since the COVID-19 pandemic. Students' learning is being shaped by their environment, and one of the influential factors may be exposure to AI. With the current data, the full picture may still present itself as unclear.

To understand the full breadth of AI in education, it is necessary to study the direct effects of AI usage on students by establishing metrics that will help measure AI education policy when it is implemented as an upscaled project for California. The same considerations should apply to other states when they want to begin integrating AI with education in the K-12 environment. Currently, the regressions suggest that even with the existence of free access to AI or ChatGPT, inequalities continue to exist in academic achievement implying there are deeper issues that serve as barriers to equity. Even if AI is implemented rapidly in low-income districts like Antioch and Pittsburg to match the speed of high-income districts like Palo Alto, the effectiveness of the policy may differ. There is a gap between policy and practice that fails to account for the organization of schools that may not be built to support new innovations introduced. The first step towards helping schools with disadvantaged students is providing the funding necessary for schools to become a supportive pillar of a students' community, regardless

of context. It is about supporting teachers throughout continuous professional development that collectively uplifts students and teachers.

There is no quick solution that can fix the academic achievement gaps caused by systemic inequalities that have bound minorities for generations. More than ever, it is necessary to correct the deep-rooted disparities that permeate society and inspire students to think outside of the box to voice perspectives that differ from the dominant perspectives typically aligned to AI automation. The fight for justice continues, and it is one that needs leaders.

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X. Appendix

1. Appendix A: Forms

Form A.1: Professors

(1) How long have you been teaching and what grade/subject have you taught?

(2) What does AI in education mean to you (positive opportunities or negative risks)?

(3) Do you have concerns about the concept of an "AI powered classroom"?

(4) What does your classroom look like and what kind of technology or digital tools do you use Do you use AI tools for teaching? (Grading, lesson plan, teaching lessons)

(5) How do you think AI has changed teaching and learning so far and what do you think will change in the next few years?

Form A.2: Teachers

(1) How do you think the emergence of AI will change school culture for teachers and Students? How will curriculum and assessments change in response?

(2) What are your thoughts on an AI-powered classroom? Do you think this will affect engagement in classrooms and student-teacher relationships?

(3) In the wake of Trump's Executive Order on Advancing Artificial Intelligence Education for American Youth, do you foresee AI classrooms as widening or narrowing achievement gaps in education? From your perspective on educational inequality, what risks do this represent historically marginalized students?

(4) What do you think are the limitations of AI use for the purpose of learning in higher education versus early education?

(5) What guidelines on the use of AI should be used to create a generation of children who Are independent thinkers and not workers reliant on machines? What is the worst possible scenario and the best possible scenario for AI use in education?

Appendix B: Tables

B.1

B.1 Table: Racial/Ethnic Demographics by District County, in Comparison to Statewide

Name	Total	African American	American Indian or Alaska Native	Asian	Filipino	Hispanic or Latino	Pacific Islander	White	Two or More Races
Contra Costa County	169,394	8.0%	0.3%	14.7%	4.2%	38.4%	0.6%	24.7%	7.6%
Santa Clara County	234,027	1.7%	0.3%	30.8%	3.6%	40.5%	0.4%	15.7%	5.9%
Statewide	5,837,690	4.9%	0.4%	9.9%	2.2%	56.1%	0.4%	20.3%	4.6%

Source: California Department of Education, *Enrollment by Ethnicity and Grade Level: 2023–24* (Antioch Unified School District data), dq.cde.ca.gov; California Department of Education, *Enrollment by Ethnicity and Grade Level: 2023–24* (Palo Alto Unified School District data), dq.cde.ca.gov.

B.2

B.2 Table Racial/Ethnic Composition by District of Selected Schools on Average

Racial/Ethnic Composition by District	Average Percent
Antioch Unified District (AUSD)	
American Indian or Alaska Native	0.7
Asian	3.133333333
Black	21.56666667
Filipino	3.733333333
Hispanic or Latino	56.96666667
Native Hawaiian or Pacific Islander	1.733333333
Two or more races	4.633333333
White	7.566666667
Pittsburg Unified District (PUSD)	
American Indian or Alaska Native	0.233333333
Asian	3.066666667
Black	10.03333333
Filipino	4.533333333
Hispanic or Latino	72.63333333
Native Hawaiian or Pacific Islander	0.533333333
Two or more races	4.9
White	3.966666667
Palo Alto Unified District (PAUSD)	
American Indian or Alaska Native	0

B.2 Table Racial/Ethnic Composition by District of Selected Schools on Average

Asian	34.66666667
Black	1.6
Filipino	0.533333333
Hispanic or Latino	20
Native Hawaiian or Pacific Islander	1.433333333
Two or more races	13.23333333
White	28.53333333

Source: Data extracted from the California School Dashboard Reports for 2024 for AUSD (Fremont, Kimball, Diablo Vista), PUSD (Parkside, Foothill, Willow Cove), PAUSD (Lucille M. Nixon, Duveneck, Barron Park)

B.3

B.3 Table

Average 'SES Disadvantage' by 'District' and 'Elementary', where 'School Year' is 2024

District	Elementary	Average SES Disadvantage
AUSD	Kimball	85.6
	Mission	84
	Belshaw	84
	Marsh	82.2
	Grant	78
	Sutter	77.1
	Jack London	77.1
	Fremont	76.3
	Turner	74.3
	Orchard	73
	Lone Tree	72.8
	Diablo Vista	62.1
	Carmen Dragon	62
	John Muir	59.7
AUSD Total		**74.87142857**
PAUSD	Barron Park	30.9
	Escondido	21.3
	El Carmelo	18.8
	Addison	17.2
	Duveneck	14.1

B.3 Table

		Palo Verde	12.6
		Walter Hays	12.6
		Fair Meadow	12.5
		Juana Briones	11.2
		Ohlone	8.4
		Herbert Hoover	6.7
		Lucille M. Nixon	6
PAUSD Total			**14.35833333**
PUSD		Parkside	85
		Heights	84.1
		Marina Vista	84
		Stoneman	81.9
		Willow Cove	79.6
		Highlands	78.1
		Los Medanos	76.1
		Foothill	73.1
PUSD Total			**80.2375**

Adapted from the School Dashboard. California Dep. Of Education.

B.4

Fig. 5 Medina, Marlene. 2023-2024 Racial/Ethnic Composition per District, 2025.

District	Total Students	African American	American Indian or Alaska Native	Asian	Filipino	Hispanic or Latino	Pacific Islander	hite	Two or More Races
Antioch Unified	16,045	23.30%	0.50%	4.60%	0.80%	50.70%	0.50%	9.70%	4.90%
Pittsburg Unified	10,709	15.40%	0.20%	3.20%	0.50%	66.00%	0.30%	4.20%	5.00%
Palo Alto Unified	10,271	1.80%	0.10%	40.50%	0.70%	15.70%	0.90%	28.90 %	11.40%

Adapted from the California Department of Education [20]. Table. CDE.

B.5 First Round Regressions

Regression: AI Access, School Year, and SES Effect on ELA & Math Achievement Per District with Comparison

	Antioch District ELA	Antioch District Math	Pittsburg District ELA	Pittsburg District Math	Palo Alto District ELA	Palo Alto District Math	ELA Achievement Comparison	Math Achievement Comparison
(Intercept)	2359.744+	1997.674*	3488.971*	3020.632+	-1149.360	663.579	1416.561+	1810.753**
	(1276.928)	(932.183)	(1547.906)	(1549.823)	(874.073)	(900.918)	(738.608)	(658.358)
AI. Access	1.542	2.540	5.085	5.202	-2.284	0.814	1.579	2.395
	(2.655)	(1.938)	(3.263)	(3.267)	(1.818)	(1.874)	(2.058)	(1.834)
SES.Disadvantage	-0.403***	-0.366***	-0.289	-0.229	-0.816***	-0.932***	-0.494***	-0.495***
	(0.089)	(0.065)	(0.176)	(0.177)	(0.087)	(0.089)	(0.063)	(0.056)
Year	-1.141+	-0.967*	-1.701*	-1.476+	0.614	-0.283	-0.658+	-0.853**
	(0.632)	(0.461)	(0.767)	(0.767)	(0.433)	(0.446)	(0.366)	(0.326)
DistrictAUSD							-24.893***	-33.253***
							(4.083)	(3.639)
DistrictPUSD							-17.937***	-27.521***
							(4.311)	(3.843)
AI.Access × DistrictAUSD							-1.637	-0.317
							(2.319)	(2.067)
AI.Access × DistrictPUSD							1.019	1.888
							(2.698)	(2.405)
Num.Obs.	70	70	40	40	60	60	170	170
R2	0.270	0.351	0.192	0.138	0.619	0.663	0.944	0.966
R2 Adj.	0.237	0.322	0.125	0.066	0.598	0.645	0.942	0.964

Regression: AI Access, School Year, and SES Effect on ELA & Math Achievement Per District with Comparison

	Antioch District ELA	Antioch District Math	Pittsburg District ELA	Pittsburg District Math	Palo Alto District ELA	Palo Alto District Math	ELA Achievement Comparison	Math Achievement Comparison
F	8.140	11.899	2.849	1.913	30.279	36.675	390.393	651.118
RMSE	6.95	5.07	6.22	6.22	4.38	4.52	6.30	5.62

- $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Adapted from the California Department of Education Reports (2019-2025). Dashboard, CAASP

B.6 Second Round Regressions

	Antioch ELA	Antioch Math	Pittsburg ELA	Pittsburg Math	Palo Alto ELA	Palo Alto Math	Compare ELA	Compare Math
(Intercept)	35.870***	26.636***	38.100***	28.055***	46.592***	42.582***	60.270***	60.613***
	(2.148)	(1.497)	(3.904)	(3.346)	(3.107)	(3.784)	(2.802)	(2.454)
AI.Access	-1.962	-0.098	1.428	0.625	-0.826	0.874	0.776	1.177
	(1.713)	(1.273)	(2.406)	(2.499)	(1.002)	(1.033)	(0.936)	(0.976)
SES.Disadvantage	-11.209***	-10.837***	-8.757+	-6.783	-21.242***	-25.504***	-15.226***	-15.242***
	(2.895)	(1.958)	(4.787)	(4.248)	(3.024)	(3.630)	(2.113)	(1.754)
Year	0.852	-0.504	-2.521	-1.313	2.023+	-0.076	-1.359+	-1.762*
	(2.203)	(1.521)	(3.128)	(3.354)	(1.112)	(1.066)	(0.787)	(0.719)
Chronic.Absenteeism.Rate	-4.782+	-2.179	-1.144	-2.046	-1.796	-0.780		
	(2.454)	(1.473)	(2.055)	(2.157)	(2.374)	(3.362)		
Suspension.Rate	-1.279	-1.579+	-0.409	-0.827	-4.944**	-4.753*		
	(1.174)	(0.791)	(1.540)	(1.819)	(1.605)	(2.024)		
DistrictAUSD							-25.548***	-33.380***
							(4.380)	(3.631)
DistrictPUSD							-17.529***	-26.766***

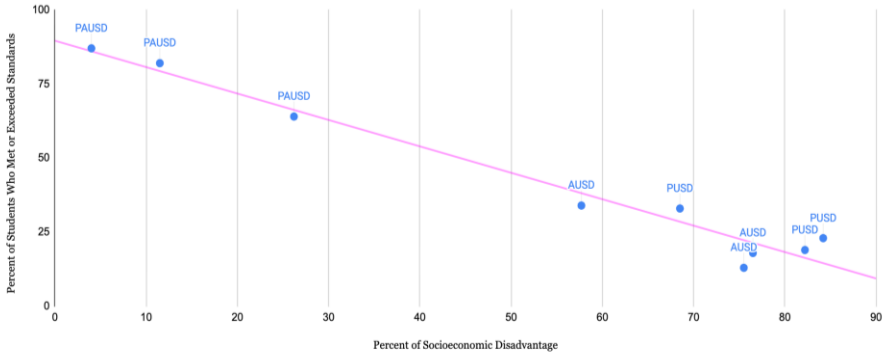
	Antioch ELA	Antioch Math	Pittsburg ELA	Pittsburg Math	Palo Alto ELA	Palo Alto Math	Compare ELA	Compare Math
							(4.613)	(3.919)
AI.Access × DistrictAUSD							-0.804	-0.156
							(1.161)	(1.008)
AI.Access × DistrictPUSD							0.501	0.928
							(1.280)	(1.288)
Num.Obs.	70	70	40	40	60	60	170	170
R2	0.441	0.483	0.206	0.188	0.659	0.691	0.944	0.966
R2 Adj.	0.397	0.442	0.089	0.068	0.628	0.662	0.942	0.964
AIC	465.4	424.1	273.0	271.4	354.8	360.0	1126.2	1087.1
BIC	481.1	439.8	284.8	283.2	369.5	374.7	1154.5	1115.4
Log.Lik.	-225.697	-205.042	-129.494	-128.691	-170.421	-173.006	-554.124	-534.571
F	9.675	13.660	1.609	1.241	23.150	22.376	463.962	710.232
RMSE	6.08	4.53	6.16	6.04	4.14	4.33	6.30	5.62
Std.Errors	HC3	HC3	HC3	HC3	HC3	HC3	HC3	HC3

- $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

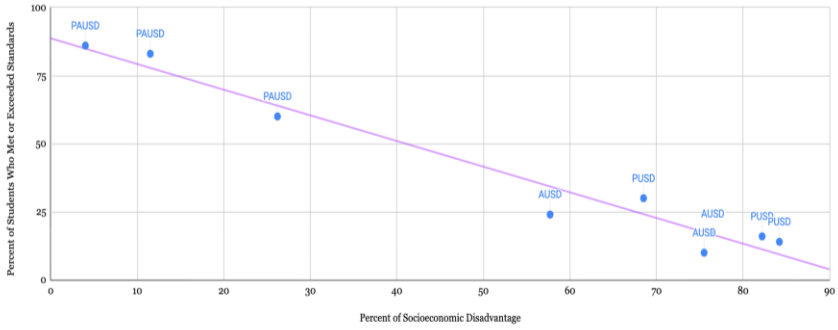
Adapted from the California Department of Education Reports (2019-2025). Dashboard, CAASP

Appendix C: Graphs

C1: 2023-24 Scores from AUSD, PUSD, PAUSD- Correlation between Socioeconomic Disadvantage and Meeting ELA Standards



C2: 2023-24 Scores from AUSD, PUSD, PAUSD- Correlation between Socioeconomic Disadvantage and Meeting Math Standards



Both Adapted from California Department of Education School Dashboard for Selected Schools of AUSD, PUSD, PAUSD