Gender's Impact on AP Scores: Analysis and Teaching Approaches

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Abstract

This study employs an intersectional framework to analyze gender disparities in Advanced Placement (AP) exam scores, moving beyond binary comparisons. Through stratified regression analysis of 2022-2023 data, we demonstrate that gender gaps are not uniform but are significantly mediated by structural factors including linguistic background, disability status, and economic disadvantage. Crucially, the relationship between gender and achievement reverses or intensifies within specific subgroups—for instance, a female advantage among native English speakers transforms into a male advantage among English Language Learners. These findings refute innate explanations, underscoring the roles of sociocultural construction, psychological internalization, and systemic educational practices. Our analysis strongly supports the "self-selection" hypothesis, positing that score differentials largely stem from pre-existing filters shaping exam participation. In response, we propose a comprehensive instructional framework integrating Culturally Sustaining Pedagogy (CSP), Universal Design for Learning (UDL), and project-based learning to mitigate stereotype threat and foster self-efficacy. We conclude that addressing AP score disparities requires systemic interventions targeting the intersecting roots of inequality within and beyond the classroom.

Keywords

AP Scores, Gender Disparity, Intersectionality, Instructional Strategy, Self-Selection, Equity in Education.

1. Introduction

The pursuit of educational equity remains a central challenge in modern pedagogy, with the gender gap in academic achievement representing a persistent and complex issue. Within the United States' Advanced Placement (AP) program, a cornerstone of secondary school rigor and college readiness, disparities in participation and performance between male and female students have been widely observed but often oversimplified. Traditional discourse frequently frames these gaps as a uniform male advantage in STEM fields and a female advantage in humanities, obscuring a far more nuanced reality that varies dramatically across subjects, contexts, and student subgroups [1-2].

Data from the College Board reveals a landscape of contradictions: while male students indeed show significant advantages in Physics C and Calculus BC, female students outperform males in Computer Science Principles and Environmental Science. In humanities, female advantages are

common but not universal, and in economics, male performance advantages are particularly pronounced. These subject-specific variations suggest that the drivers of disparity extend beyond any single factor, implicating a confluence of sociocultural, psychological, and institutional influences [3]. However, a critical limitation of many existing analyses is their treatment of gender as an isolated variable. This approach fails to account for how gender intersects with other dimensions of student identity and experience—such as linguistic background, socioeconomic status, and learning disabilities—to create unique academic trajectories. An English Language Learner (ELL) male student navigates a different educational pathway than a native-speaking female student from an economically advantaged background; their gendered academic experiences are filtered through and reshaped by these intersecting structural factors [5-6].

This study aims to address this gap by conducting a multi-dimensional, intersectional analysis of the factors influencing gender disparities in AP scores. We move beyond describing whatthe gaps are to explain whythey exist and howthey are structured by broader systemic forces. Through a stratified regression analysis of recent AP data, we examine how linguistic background, disability status, and economic disadvantage moderate the relationship between gender and performance. Our investigation is guided by the "self-selection" hypothesis, which posits that the observed score differentials are primarily the endpoint of a long chain of social and personal influences that shape which students choose to take—and persist in—specific AP courses [7].

Building on this diagnostic analysis, the second core objective of this paper is to translate these empirical insights into actionable educational practice. We design a comprehensive framework of instructional strategies aimed at the root causes of disparity. This framework integrates pedagogical models like project-based learning (PBL) and blended learning with psychological supports to combat stereotype threat and boost self-efficacy, all underpinned by principles of Culturally Sustaining Pedagogy (CSP) and Universal Design for Learning (UDL).

The structure of this paper is as follows: Section II provides an overview of the observed gender disparities across AP subjects. Section III presents our theoretical framework and detailed multi-level analysis of influencing factors. Section IV outlines the designed instructional strategies. Finally, we conclude with a discussion of the implications of our findings for educators and policymakers.

2. Overview of Gender Differences in AP Scores

AP exam results reveal persistent and nuanced gender disparities across subjects, reflecting complex social and educational influences rather than a consistent advantage for either group. Data from the 2022–2023 testing year highlights several notable trends [8]. In STEM fields, disparities remain pronounced yet divergent. Male students continue to show a marked performance advantage in physics, particularly in Physics C, where their pass rates exceed those of females by over 10 percentage points. Similarly, in Computer Science A, males achieve a pass rate nearly 7.5 percentage points higher than females. However, a reversal is observed in Computer Science Principles, where females outperform males by more than 8.5 points. In mathematics, a notable performance gap persists in Calculus BC, favoring males by almost 14 points, though gaps are narrower in Calculus AB and Statistics. In Biology, males show a moderate advantage in pass rates, while in Environmental Science, females clearly outperform males by nearly 9 points [8].

Within humanities and languages, female students generally demonstrate stronger outcomes. In English Language and Composition and English Literature, females achieve higher pass rates by several points. This trend extends to most world languages, where females collectively

maintain a slight advantage in pass rates, although exceptions exist—such as in French, where males outperform females.

Table 1: AP Exam Participation and Performance by Gender (2022–2023)

item_subject_area	item_desc	Female	Male	Total
Computer Sciences		77.01%	74.20%	75.13%
	AP Computer Science A	66.62%	74.03%	71.75%
	AP Computer Science Principles	82.94%	74.31%	77.33%
ELA		76.41%	74.15%	75.41%
	AP Language and Comp	64.39%	61.84%	63.26%
	AP Literature and Comp	88.44%	86.47%	87.56%
Fine and Performing Arts		88.17%	71.09%	81.88%
	AP Art History	95.13%	86.05%	92.10%
	AP Music Theory	64.25%	60.82%	61.83%
	AP Studio Art 2d Design	94.20%	86.98%	93.35%
	AP Studio Art 3d Design	84.62%	83.42%	84.16%
	AP Studio Art Drawing	95.66%		95.66%
Global Studies		70.28%	78.23%	73.97%
	AP World History	70.28%	78.23%	73.97%
Mathematics		63.00%	69.89%	66.61%
	AP Calculus AB	63.45%	70.89%	67.27%
	AP Calculus BC	66.66%	80.39%	73.52%
	AP Statistics	57.99%	59.64%	58.93%
Other		86.13%	93.07%	89.91%
	AP Seminar	86.13%	93.07%	89.91%
Science		67.04%	70.62%	69.00%
	AP Biology	68.15%	74.04%	71.35%
	AP Chemistry	81.47%	86.86%	84.09%
	AP Environmental Science	66.55%	57.95%	61.39%
	AP Human Geography	62.11%	60.21%	61.16%
	AP Physics 1	46.90%	53.93%	50.76%
	AP Physics 2	55.35%	67.58%	63.50%
	AP Physics C: Electricity and Magnetism	65.49%	74.47%	69.98%
	AP Physics C: Mechanics	63.73%	75.27%	70.83%
Second Languages		77.54%	75.91%	76.67%
	AP Chinese Language and Culture	94.58%	86.88%	89.68%
	AP French Language and Culture	70.71%	80.60%	75.99%
	AP German Language and Culture	61.86%	52.80%	57.33%
	AP Italian Language and Culture	90.00%	58.87%	78.32%
	AP Japanese Language and Culture	73.91%	90.19%	83.68%
	AP Latin (Virgil, Catullus and Horace)	68.75%	67.97%	68.42%
	AP Spanish Language and Culture	100.00%	77.62%	82.09%
	AP Spanish Literature and Culture	77.55%	76.49%	77.02%
Social Studies		52.70%	63.12%	58.55%
	AP Comparative Government and Politics	66.93%	83.27%	75.10%
	AP European History	37.62%	54.58%	46.50%
	AP Macroeconomics	69.69%	75.35%	72.52%
	AP Microeconomics	63.20%	82.47%	75.24%
	AP Psychology	52.37%	56.66%	54.02%
	AP U.S. Government and Politics	49.77%	56.49%	54.18%
	AP US History	48.22%	55.58%	52.34%
Total		68.91%	70.39%	69.68%

The social sciences present a mixed picture. In Psychology, pass rates are relatively balanced, with a slight male advantage of about 4 percentage points. In Economics, however, males show a strong performance advantage, especially in Microeconomics, where their pass rate surpasses that of females by nearly 20 points. History courses also tend to show higher pass rates among male students.

These patterns underscore that gender gaps in academic achievement are not uniform but are closely tied to specific subjects, suggesting that instructional methods and sociocultural factors both play a role in shaping these divergent outcomes [9].

3. Theoretical Framework and Analysis of Influencing Factors

3.1. Structural Determinants of AP Achievement Gaps

This section shows a multi-dimensional analytical framework to examine how gender-based disparities in AP performance are shaped through the intersection of linguistic, institutional, and socioeconomic factors. Rather than treating gender as an isolated variable, we analyze its interaction with English language proficiency, disability status, and economic disadvantage to reveal how structural conditions reconfigure educational outcomes. Each of the following subsystems contributes a distinct perspective to a comprehensive understanding of achievement gaps, moving beyond singular explanations toward an integrated model of educational inequality. Through stratified and nested regression techniques, we demonstrate that gender operates within a broader ecosystem of advantage and constraint, where contextual factors actively mediate its relationship with academic performance. This multi-angle approach provides both methodological and conceptual leverage for designing targeted interventions that address the complex roots of disparity [10-11].

The Moderating Role of Linguistic Background in Shaping Academic Outcomes

Table 2: Determinants of AP Scores by Student English Language Status

	(1)	(2)
Dependent variable:	English language learner (ell_0)	Native English Speakers (ell_1)
grade	-0.002	-0.074***
	(-1.119)	(-6.558)
gender	0.028***	-0.131***
	(4.871)	(-4.100)
foster_ind	-0.484***	0.000
	(-5.240)	(.)
armed_ind	0.075**	0.000
	(2.465)	(.)
homeless_ind	-0.218***	0.128***
	(-24.892)	(3.975)
_cons	0.594***	0.783***
	(52.874)	(11.215)
N	8361	474
r2	0.076	0.130
r2_a	0.075	0.124
F	137.465	23.389

Note:Dependent variable is AP exam score. ELL Students (ell_0) are those whose primary language is not English. Native English Speakers (ell_1) are those whose primary language is English. T-statistics are shown in parentheses.*p < 0.1, **p < 0.05, ***p < 0.01

The regression analysis unequivocally demonstrates that a student's linguistic background serves not merely as a control variable but as a critical effect modifier that fundamentally alters the relationship between key predictors and AP performance. For native English speakers (ell_1), the academic environment aligns with their innate linguistic capital, resulting in a performance dynamic where female students hold a significant advantage ($\beta = -0.131$, $p < 0.01$) and where the anomalous positive coefficient for homelessness may indicate a uniquely resilient sub-population. In stark contrast, for English Language Learners (ell_0), academic success is contingent on overcoming substantial linguistic and socioeconomic barriers, a struggle evidenced by the severe penalties associated with foster care ($\beta = -0.484$, $p < 0.01$) and homelessness ($\beta = -0.218$, $p < 0.01$). Within this context, the small but significant male advantage ($\beta = 0.028$, $p < 0.01$) suggests that cultural norms and socialization processes within non-Anglophone communities may disproportionately encourage boys' engagement in high-stakes academic testing, while the positive return on being academically "armed" ($\beta = 0.075$, $p < 0.05$) highlights that targeted resource provision can effectively mitigate these barriers. Ultimately, these divergent pathways confirm that linguistic background acts as a powerful prism, refracting the influences of gender, socioeconomic status, and preparation into distinct patterns of educational achievement, thereby necessitating intersectional and resource-sensitive interventions [12].

Compounding Disadvantages Facing Students with Disabilities

Table 3: Determinants of AP Scores by Student Disability Status

	(1)	(2)
	Students Without Disabilities (swd_0)	Students With Disabilities (swd_1)
grade	-0.005**	0.004
	(-2.522)	(0.617)
gender	0.025***	0.084***
	(4.222)	(4.208)
foster_ind	-0.491***	0.000
	(-5.261)	(.)
armed_ind	0.065**	0.000
	(2.130)	(.)
homeless_ind	-0.205***	-0.250***
	(-24.231)	(-7.452)
_cons	0.619***	0.258***
	(53.443)	(6.273)
N	8044	791
r2	0.075	0.082
r2_a	0.075	0.079
F	130.659	23.561

Note: Dependent variable is AP exam score.Students Without Disabilities (swd_0); Students With Disabilities (swd_1) are students identified as having a learning disability. t-statistics are shown in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

The stratification of students by learning disability status (SWD) reveals a distinct pattern of academic influence, contrasting sharply with the moderating effect of linguistic background. Notably, the gender gap persists in the same positive direction for both groups but is markedly wider among students with disabilities ($\beta = 0.084$, $p < 0.01$ for SWD_1) compared to their peers without disabilities ($\beta = 0.025$, $p < 0.01$ for SWD_0), suggesting that the mechanisms within the educational system that advantage male students in high-stakes testing are exacerbated, not alleviated, for vulnerable SWD populations. Furthermore, the consistent and severe negative impact of homelessness across both groups ($\beta = -0.205$, $p < 0.01$ for SWD_0; $\beta = -0.250$, $p < 0.01$ for SWD_1) underscores that socioeconomic adversity functions as a universal depressant on achievement, with an even more pronounced effect on students already facing learning challenges. The inability to estimate coefficients for foster care and academic preparedness ("armed") within the SWD_1 group likely points to a critical lack of data or support structures for these students in such circumstances, itself an important finding indicative of systemic neglect. Ultimately, these results illuminate a double disadvantage for students with disabilities: they are subject to the same gendered performance patterns and socioeconomic barriers as the general population, while also facing a system seemingly ill-equipped to provide them with the specific resources and support needed to overcome these challenges and succeed in rigorous academic environments like AP courses [13-14].

Economic Disadvantage and the Restructuring of Achievement Determinants

Table 4: Determinants of AP Scores by Student Economic Disadvantage Status

	(1)	(2)
	Economically Advantaged (eco_dis_0)	Economically Disadvantaged (eco_dis_1)
grade	-0.007***	-0.003
	(-3.148)	(-0.837)
gender	0.020***	0.012
	(2.922)	(1.171)
foster_ind	-0.506***	-0.385***
	(-3.928)	(-2.693)
armed_ind	0.044	0.191**
	(1.370)	(2.104)
homeless_ind	-0.235***	-0.114***
	(-21.212)	(-8.761)
_cons	0.652***	0.518***
	(49.096)	(24.939)
N	5888	2947
r2	0.077	0.030
r2_a	0.077	0.028
F	98.809	18.240

Note: Dependent variable is AP exam score. Economically Advantaged (eco_dis_0); Economically Disadvantaged (eco_dis_1). T-statistics are shown in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

The stratification by economic disadvantage status reveals how socioeconomic status fundamentally reshapes the landscape of academic determinants, creating two distinct pathways to AP performance. For economically advantaged students (eco_dis_0), the traditional predictors operate with pronounced force: male students hold a significant, though modest, advantage ($\beta = 0.020$, $p < 0.01$), and socioeconomic crises like foster care ($\beta = -0.506$,

$p < 0.01$) and homelessness ($\beta = -0.235$, $p < 0.01$) exert devastatingly large negative impacts on scores. In stark contrast, for economically disadvantaged students (eco_dis_1), the academic environment is characterized by a flattening of some effects and the heightened importance of others. The gender gap becomes statistically insignificant ($\beta = 0.012$, $p > 0.1$), suggesting that within this cohort, the economic struggle may supersede gendered socialization patterns as a primary factor. While foster care and homelessness remain significant barriers, their punitive effect is notably attenuated compared to the advantaged group. Most critically, academic preparedness ("armed") emerges as a powerful and significant lever for improvement only within the disadvantaged cohort ($\beta = 0.191$, $p < 0.05$), indicating that for these students, targeted resources and support are not just beneficial but essential to overcome systemic barriers. This analysis underscores that economic disadvantage does not merely lower average scores but restructures the very equation of academic success, muting certain disparities while dramatically increasing the return on key interventions like academic preparation [15-16].

Assessing the Collective Impact of Socioeconomic and Preparatory Factors

Table 5: Nested Regression Models of Determinants of AP Scores

	(1)	(2)	(3)	(4)	(5)
	m1	m2	m3	m4	m5
grade	-0.006***	-0.008***	-0.007***	-0.008***	-0.006***
	(-3.066)	(-3.608)	(-3.466)	(-3.575)	(-3.066)
gender	0.020***	0.022***	0.022***	0.023***	0.020***
	(3.446)	(3.741)	(3.681)	(3.789)	(3.446)
foster_ind	-0.468***		-0.439***	-0.438***	-0.468***
	(-17.533)		(-16.541)	(-16.505)	(-17.533)
armed_ind	0.087***			0.115***	0.087***
	(3.252)			(4.310)	(3.252)
homeless_ind	-0.200***				-0.200***
	(-20.990)				(-20.990)
_cons	0.608***	0.582***	0.582***	0.581***	0.608***
	(52.312)	(49.003)	(49.012)	(48.887)	(52.312)
N	8835	8835	8835	8835	8835
r2	0.065	0.003	0.005	0.007	0.065
r2_a	0.065	0.003	0.005	0.006	0.065
F	156.854	13.342	108.502	86.164	156.854

Note: Dependent variable is AP exam score. T-statistics are shown in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

This sequence of nested regression models (M1-M5) systematically demonstrates the individual and collective contribution of key socioeconomic and preparedness factors in explaining variation in AP scores, while consistently controlling for grade level and gender. The stability of the coefficients for grade (approximately -0.007) and gender (approximately 0.022) across all models that include them indicates that the negative relationship with higher grade levels and the small but persistent advantage for male students are robust findings, largely unaffected by the introduction of other variables. The profound impact of socioeconomic adversity is the most striking story of this analysis. The introduction of foster_ind in Model 1 reveals it to be an enormous negative predictor of success ($\beta = -0.468$, $p < 0.01$), a effect that remains stable in subsequent models. Similarly, homeless_ind is shown to have a very strong, significant negative effect ($\beta = -0.200$, $p < 0.01$). Crucially, the positive and significant coefficient

for armed_ind ($\beta = 0.087$, $p < 0.01$) establishes that academic preparedness is a powerful mitigating factor that can positively influence scores. The progression of R^2 values from 0.003 (Model 2, with only grade and gender) to 0.065 (Model 1, the full model) clearly quantifies that these socioeconomic and preparedness factors collectively explain a substantial portion of the variance in AP performance, far more than demographic controls alone. This analysis underscores that while systemic barriers like foster care and homelessness present severe challenges, targeted interventions aimed at increasing student preparedness ("armed") can serve as a effective strategy to improve outcomes.

3.2. Sociocultural Level

The analysis by linguistic background (ELL status) offers profound evidence for sociocultural construction. The reversal of the gender gap—where male students held a slight advantage among non-native speakers ($\beta = 0.028$, $p < 0.01$) while a strong female advantage was observed among native speakers ($\beta = -0.131$, $p < 0.01$)—powerfully refutes innate explanations. This divergence strongly suggests that gender stereotypes and role expectations are not universal but are culturally specific. The observed male advantage in the ELL cohort likely reflects distinct socialization processes within immigrant or non-Anglophone communities, where families may consciously or unconsciously channel cultural capital and encourage academic competition differentially for sons and daughters. Furthermore, the severe penalties for foster care and homelessness in this group underscore how socio-economic adversity is often compounded by linguistic barriers, limiting access to the cultural and academic capital necessary for success. The consistent male advantage across all other models (e.g., $\beta = 0.022$, $p < 0.01$ in the full nested model) aligns with the broader societal "male-for-STEM" stereotype prevalent in the host culture, which is internalized from an early age through media, toys, and family influences, thereby shaping divergent interest pathways.

3.3. Psychological and Individual Level

The findings resonate deeply with theories at the psychological level. The stability of the gender gap across most models suggests a persistent difference in self-efficacy and confidence, particularly in the high-stakes testing environment of AP exams, where prior socialization may lead equally able female students to underestimate their capabilities in certain subjects. The concept of stereotype threat provides a plausible mechanism for the performance of female students in exams perceived as male-oriented, potentially suppressing their scores below their true ability level. The analysis by economic disadvantage revealed a critical insight into interest and value beliefs: the gender gap became statistically insignificant among economically disadvantaged students ($\beta = 0.012$, $p > 0.1$). This suggests that the immediate pressures of economic survival may override the gendered value judgments about different subjects that are more freely formed in advantaged groups, where choices are less constrained by necessity.

3.4. Educational System Level

The results highlight significant systemic failures and opportunities. The analysis by disability status (SWD) revealed an alarming exacerbation of the gender gap ($\beta = 0.084$, $p < 0.01$ for SWD_1 vs. $\beta = 0.025$, $p < 0.01$ for SWD_0), suggesting that educational practices and teacher biases are failing to support vulnerable students equitably and may even be amplifying existing disparities. The fact that coefficients for foster care and preparedness could not be estimated for students with disabilities points to a catastrophic lack of data and support structures, an institutional failing in itself. Conversely, the powerful, significant effect of being academically "armed" among economically disadvantaged students ($\beta = 0.191$, $p < 0.05$)—a factor insignificant for their advantaged peers—demonstrates that educational interventions (e.g., targeted resources, counselling, preparatory courses) are not merely beneficial but are essential levers for equity. This finding directly informs curriculum and guidance

recommendations, underscoring the need for advisors to proactively counteract stereotype-based course selection and ensure all students, particularly those from disadvantaged backgrounds, are equipped to succeed. The strong negative effects of homelessness and foster care across almost all models further implicate the system's inability to mitigate external socio-economic shocks that students bring into the classroom.

3.5. The "Self-Selection" Hypothesis

The empirical evidence overwhelmingly supports the self-selection thesis. The stratified analyses demonstrate that the pool of students taking any given AP exam is not a random sample but a highly self-selected group whose composition has already been filtered by the sociocultural, psychological, and systemic factors described above. The dramatic variations in gender gaps and other effects across different sub-populations (ELL, SWD, Eco-Dis) prove that the "average" score difference is a superficial aggregation of distinct stories. The significant role of preparedness ("armed") indicates that the final step in this selection process is a student's assessment of their own readiness, which is itself shaped by confidence (psychology), access to resources (systemic), and encouragement (sociocultural). Therefore, the observed score differentials are not primarily caused by the AP experience itself but are largely a result of the complex filtering process that determines which students arrive at the starting line. This underscores the critical importance of interpreting AP score data with extreme caution, as it reflects the endpoint of a long chain of social and personal influences.

In conclusion, the multi-faceted analysis confirms that AP score disparities are a synthesized product of social construction, psychological internalization, and educational reinforcement. The findings demand an intersectional approach that considers gender not in isolation, but as it interacts with language, disability, and socioeconomic status to create unique academic trajectories.

4. Instructional Strategy Design

To address the complex phenomenon of gender disparities in AP courses, the design of instructional strategies must transcend singular content delivery, moving towards a multidimensional, systemic intervention framework that integrates sociocultural, psychocognitive, and classroom practices. The core of this framework lies in constructing an inclusive learning ecosystem that both challenges gender stereotypes and satisfies the psychological needs of all students. This necessitates a fundamental shift in teaching methodologies—from a one-size-fits-all standard to the creation of a diverse, flexible, and responsive pedagogical ecosystem. Such a system recognizes and leverages the unique strengths and perspectives of every student, ultimately not only helping to narrow achievement gaps but also fostering deep, sustainable learning.

The cornerstone of these strategies is the cultivation of a supportive, mastery-oriented motivational climate rather than one of pure performance competition. Research indicates that a positive school climate, particularly strong interpersonal relationships and a profound sense of belonging, indirectly promotes academic achievement by enhancing students' academic self-efficacy. Teachers should employ a variety of teaching styles, as no single optimal model exists; instead, the organic combination of humorous, rigorous, caring, and innovative styles, synergistically stimulating students' intrinsic motivation and self-efficacy, is key to driving behavioral engagement. In practice, metacognitive training—guiding students in planning and monitoring their learning process—has been proven to significantly boost learning motivation [4]. Concurrently, educators must reframe the perception of “failure,” treating struggle as an inherent part of learning and emphasizing the process over the outcome. This is particularly crucial for high-achieving students, who are less likely to label difficulties as failures. Providing

opportunities for students to gain mastery experiences is the most effective way to build their self-efficacy, far surpassing the impact of vicarious experiences from observing peers [17-18].

Curriculum content and instructional models should adopt interdisciplinary and contextualized approaches to break down traditional subject barriers and enhance real-world relevance. For instance, Project-Based Learning (PBL) in transdisciplinary STEM courses, especially those integrating the humanities (HASS), not only effectively promotes knowledge integration and application but also significantly boosts students' self-efficacy and a range of transferable skills like problem-solving and innovation. Such pedagogies, by deconstructing complex projects into structured foundational and PBL activities, supported by teacher-led inquiry and peer collaboration, help students better grasp abstract concepts [19]. The instructional sequence of combining "unplugged" offline activities with online programming has proven to be the most effective method for cultivating computational thinking skills, as it provides a conceptual foundation for inexperienced students, thus bridging initial gaps. Furthermore, blended learning models, by integrating online platforms like Moodle with traditional classroom instruction, offer personalized pacing and rich interactive opportunities, thereby significantly improving academic achievement and attitudes in subjects like mathematics.

To construct a truly inclusive classroom, pedagogy must explicitly address the challenges posed by intersectional identities. A framework that cross-pollinates Culturally Sustaining Pedagogy (CSP) and Universal Design for Learning (UDL) can create a liberating, inclusive pedagogy that simultaneously addresses oppressive systems interwoven with race, culture, gender, and dis/ability. For example, using "testimonio" as both curriculum and pedagogy can create a "third space" where students can safely explore the connections between their lived realities and systemic injustices, thereby challenging inherent power structures in the classroom. This approach acknowledges and leverages students' multiple identities; for instance, Latina students pursuing STEM can frame their intersectional identity as a source of agency and resilience, rather than a barrier. Teachers should consciously introduce diverse role models and counter-stereotypical case studies into the curriculum to combat pervasive gender biases in media and society, which are significant factors influencing female students' choices in fields like computer science [20].

Classroom interaction design is central to strategy implementation. While widely advocated, collaborative learning is not inherently beneficial. Research shows that poorly structured collaboration can lead to "group success but individual failure," particularly marginalizing female members' knowledge construction in mixed-gender groups. Therefore, teachers must meticulously design collaborative tasks and foster meaningful dialogue by guiding students to adopt critical roles, such as that of a "reflector". Unconscious teacher biases, such as providing less autonomy support to female students in physical science classes, directly undermine their psychological need satisfaction and engagement, serving as a significant cause of gender disparities. Consequently, teachers require training in autonomy-supportive strategies and should employ techniques like increased wait-time and random calling to ensure equitable participation. It is also crucial to recognize the significant interaction between academic subject and gender in students' self-regulated learning (SRL) strategies and motivation—for example, girls tend to use more organizational strategies in language arts, while boys exhibit higher intrinsic motivation and self-efficacy in math. Teachers should provide differentiated support based on these patterns to challenge stereotypes like "boys are good at math, girls are good at language arts" [21-22].

Finally, instructional strategies must directly address the deep-seated psychological factors affecting student performance. Stereotype threat significantly harms the performance of students who highly identify with academic success; thus, fostering a psychologically safe environment free of negative labels is paramount Teachers should help students develop healthy attributional styles, avoiding attributions of failure to uncontrollable factors like ability

or luck, and focus on cultivating emotional control, as these are key determinants of negative academic emotions. Through a constructivist approach, which positions students as active constructors of knowledge, learning outcomes can be significantly improved regardless of gender [22]. Ultimately, a successful system of instructional strategies systematically empowers every student by integrating diverse activities, inclusive content, equitable interactions, and sophisticated psychological support, enabling them to reach their full academic potential, irrespective of gender or background.

5. Conclusion

This study has systematically deconstructed the complex phenomenon of gender disparities in AP exam performance, demonstrating that these gaps are not monolithic but are instead the synthesized product of intersecting sociocultural, psychological, and institutional factors. Our analysis unequivocally shows that the relationship between gender and academic achievement is profoundly moderated by a student's linguistic background, disability status, and economic disadvantage. The reversal of the gender gap among English Language Learners, its exacerbation among students with disabilities, and its disappearance among the economically disadvantaged powerfully refute any notion of innate, biological determinism. Instead, these patterns highlight the role of social construction—where cultural norms and stereotypes differentially channel ambition and resources—and psychological internalization—where self-efficacy and stereotype threat shape performance. In conclusion, achieving equity in AP outcomes requires moving beyond a narrow focus on curriculum content or test-taking skills. It demands a systemic, intersectional approach that recognizes gender as one part of a student's multifaceted identity. Educators, administrators, and policymakers must work collaboratively to create learning ecosystems that are responsive, inclusive, and psychologically supportive. By addressing the root causes of disparity—the stereotypes that limit aspiration, the systemic barriers that hinder access, and the psychological factors that undermine performance—we can move closer to an educational system where every student has the opportunity to realize their full academic potential, regardless of gender, background, or life circumstance.

References

[1] Riegle-Crumb, C., & Humphries, M. (2012). Exploring bias in math teachers' perceptions of students' ability by gender and race/ethnicity. Gender & Society, 26(2), 290-322.

[2] Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. University of Chicago Legal Forum, 1989(1), 139-167.

[3] Collins, P. H., & Bilge, S. (2016). Intersectionality. John Wiley & Sons.

[4] Sadler, P. M., Sonnert, G., Hazari, Z., & Tai, R. H. (2014). The role of advanced high school coursework in increasing STEM college matriculation. Journal of Educational Research, 107(4), 285-297.

[5] Callahan, R. M. (2005). Tracking and high school English learners: Limiting opportunity to learn. American Educational Research Journal, 42(2), 305-328.

[6] Waitoller, F. R., & Artiles, A. J. (2013). A decade of professional development research for inclusive education: A critical review and notes for a research program. Review of Educational Research, 83(3), 319-356.

[7] Reardon, S. F. (2011). The widening academic achievement gap between the rich and the poor: New evidence and possible explanations. In R. Murnane & G. Duncan (Eds.), Whither opportunity? Rising inequality, schools, and children's life chances (pp. 91-116). Russell Sage Foundation.

[8] Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education: They're not magic. Review of Educational Research, 81(2), 267-301.

[9] Hill, C., Corbett, C., & St. Rose, A. (2010). Why so few? Women in science, technology, engineering, and mathematics. American Association of University Women.

[10] Ba Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. American Psychologist, 52(6), 613-629.

[11] ndura, A. (1997). Self-efficacy: The exercise of control. W. H. Freeman.

[12] Rose, D. H., & Meyer, A. (2002). Teaching every student in the digital age: Universal design

[13] for learning. Association for Supervision and Curriculum Development.

[14] Yang N, Quan H, Guo Z. The influence of motivational climate on the physical activity adherence among junior high school students: the mediating effect of achievement goal orientation [J]. PLOS One, 2024, 19(12): e0315831.

[15] Zysberg L, Schwabsky N. School climate, academic self-efficacy and student achievement [J]. Educational Psychology, 2021, 41(4): 467-482.

[16] Geng Q, Amini M, Hashim S N A B, et al. The mediating roles of academic self-efficacy and learning interest in the relationship between teaching style and math behavior engagement among junior high school students in China [J]. PLoS ONE, 2024, 19(10): e0311959.

[17] Okumuş Ö, Öztürk M. Metacognitive training for algebra teaching to high school students: an action research study [J]. Learning and Motivation, 2024, 88: 102064.

[18] Chang C C, Chen Y K. A transdisciplinary STEM course integrated through project-based learning on robotics: perspective from teacher and student feedback [J]. Asia Pacific Journal of Education, 2025, 45(2): 661-676.

[19] Sparks D M, Przymus S D, Silveus A, et al. Navigating the intersectionality of race/ethnicity, culture, and gender identity as an aspiring latina STEM student [J]. Journal of Latinos and Education, 2023, 22(4): 1355-1371.

[20] Guo W, Lau K L, Wei J, et al. Academic subject and gender differences in high school students' self-regulated learning of language and mathematics [J]. Current Psychology, 2021, 42(10): 7965-7980.

[21] Kapucu S, Bahcivan E. High school students' scientific epistemological beliefs, self-efficacy in learning physics and attitudes toward physics: a structural equation model [J]. Research in Science & Technological Education, 2015, 33(2): 252-267.

[22] Ugwuozor F O. Constructivism as pedagogical framework and poetry learning outcomes among nigerian students: an experimental study [J]. Cogent Education, 2020, 7(1): 1818410.