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Comparative Study of Influence of Co- Curricular Activities on Academic Progress of Male and Female Students at Secondary Schools in District, Toba Tek Singh

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ABSTRACT

This article examines the empirical relationship between co-curricular activity (CCA) participation and academic achievement among 10th-grade students in District Toba Tek Singh, Punjab. Utilizing a quantitative descriptive-comparative and correlational design with a stratified random sample ($N = 400$) across public and private secondary schools, student engagement metrics were paired with verified Board of Intermediate and Secondary Education (BISE) Faisalabad annual examination scores. Polynomial quadratic regression reveals a statistically significant non-linear, inverted U-shaped relationship ($p < .001$) between weekly CCA participation and academic outcomes. An optimal empirical tipping point of 4.5 hours per week was identified. Moderate engagement enhances focus, mitigates exam anxiety, and builds executive function, whereas engagement exceeding 6.0 hours yields diminishing returns due to physical fatigue and study time displacement. Significant gender and sectoral disparities were also observed: male students recorded higher weekly activity hours, yet female students achieved higher board examination averages through focused involvement in indoor literary pursuits. These findings challenge both the traditional "zero-sum" assumption and unrestricted developmental models, offering concrete benchmarks for educational administrators and parents in high-stakes examination ecosystems.

Introduction

For decades, secondary education systems across South Asia have prioritized rote-oriented academic instruction aimed almost exclusively at performance in high-stakes terminal examinations. In Punjab, Pakistan, 10th-grade board examination scores administered by regional statutory bodies like BISE Faisalabad serve as the sole gateway for college admissions and future professional trajectories. Consequently, school managers, teachers, and parents

frequently operate under a rigid Zero-Sum Model. This framework assumes that any hour devoted to the playing field, debate stage, or scouting troop is time directly stolen from the study table, inevitably causing academic decline.

Conversely, modern educational psychology advocates for a Developmental Model rooted in holistic development. This perspective argues that co-curricular activities (CCAs)—ranging from competitive athletics to literary societies—act as academic catalysts. Grounded in Astin's (1984) Theory of Student Involvement and Gardner's (1983) Theory of Multiple Intelligences, structured non-academic participation fosters institutional connectedness, builds psychological resilience, and refines bodily-kinesthetic, interpersonal, and linguistic executive functions.

Despite theoretical endorsements, empirical clarity remains lacking within semi-urban and agrarian districts like Toba Tek Singh. In these transitional socio-economic environments—comprising tehsils Toba Tek Singh, Gojra, Kamalia, and Pirmahal—entrenched cultural practices regarding gender roles, restricted female mobility (Parda), and seasonal agricultural disruptions fundamentally alter how students access and balance non-academic pursuits. This study investigates whether co-curricular engagement acts as a structural hindrance or a cognitive asset within this competitive ecosystem.

The 21st-century educational paradigm has driven a fundamental shift in how student success is evaluated, moving beyond traditional metrics centered strictly on rote memorization and high-stakes examination scores (Dewey, 1938/1997). Modern pedagogy increasingly emphasizes a holistic framework integrating cognitive, emotional, social, and physical development (Mahmood et al., 2021). At the center of this integrated educational model are Co-Curricular Activities (CCAs)—structured, non-academic programs designed to complement and enrich the core academic curriculum. In secondary education, these activities encompass a wide range of pursuits, including competitive athletics, declamation and debate societies, scouting and girl guides, Qirat and Naat competitions, and aesthetic arts. Far from being mere leisure pastimes, CCAs serve as practical arenas for cultivating essential soft skills, executive function, leadership capabilities, and institutional belonging (Mahmood et al., 2021).

The dynamic between non-academic engagement and academic achievement remains a central debate in educational psychology. Traditionally prevalent in examination-centric systems like Pakistan's, the Zero-Sum Model views time as a strictly finite resource (Rehman & Haider, 2022). This framework posits that every hour dedicated to sports, debate preparation, or artistic pursuits directly subtracts from academic study time, thereby risking lower examination performance (Rehman & Haider, 2022). Conversely, the Identification-Commitment Model, grounded in Astin's (1984) Theory of Student Involvement, argues that energy invested in school-sponsored activities deepens student connectedness to the institution (Khan & Ahmed, 2023). This institutional bond enhances time-management skills, builds emotional resilience, and reduces examination stress, which ultimately yields positive spillover effects into academic performance (Khan & Ahmed, 2023). Complementing this perspective is Gardner's (1983) Theory of Multiple Intelligences, which asserts that academic and personal development relies not solely on linguistic and logical-mathematical abilities, but also on bodily-kinesthetic, spatial, and interpersonal intelligences fostered through co-curricular engagement.

In central Punjab, gender plays a defining role in shaping how secondary school students interact with their educational environment (Zafar, 2020). Socio-cultural norms influence both the level

of access to and the specific types of CCAs available to students (Zafar, 2020). Male students generally benefit from greater physical mobility and societal encouragement to participate in outdoor, competitive athletics such as cricket and football. While these activities foster physical stamina, leadership, and teamwork, they also require careful scheduling to prevent physical exhaustion during peak examination cycles. Female students are frequently guided toward indoor literary pursuits, declamation contests, Qirat/Naat recitations, and visual arts due to cultural norms, institutional constraints, and safety considerations (Parda) (Zafar, 2020). These activities heavily exercise verbal reasoning, critical thinking, and language fluency, directly supporting performance in humanities and language arts subjects. Understanding these gender-differentiated participation patterns is critical for identifying structural disparities and ensuring equitable educational opportunities across local school systems (Zafar, 2020).

District Toba Tek Singh—comprising the four tehsils of Toba Tek Singh, Gojra, Kamalia, and Pirmahal—operates under the academic supervision of the Board of Intermediate and Secondary Education (BISE) Faisalabad. Secondary education in this region is characterized by high stakes, as Grade 10 examination marks serve as the primary gateway for entry into prestigious higher secondary institutions and competitive professional tracks. In this environment, school administrators and parents often relegate non-academic programs to the background in favor of intensive exam preparation (Government of the Punjab, 2024). Evaluating whether structured participation in CCAs offers tangible cognitive and psychological benefits within this local socio-economic environment provides the empirical backing needed to balance academic rigor with holistic student development.

Problem Statement

Despite growing global recognition of the cognitive and psychological benefits of co-curricular activities, secondary education under BISE Faisalabad in District Toba Tek Singh remains overwhelmingly focused on high-stakes terminal board examination scores (Government of the Punjab, 2024; Mahmood et al., 2021). This exam-centric paradigm reinforces the traditional Zero-Sum Model among local parents and educators, who frequently view time spent on sports, debates, and arts as a direct threat to academic performance (Rehman & Haider, 2022). Compounding this issue are entrenched socio-cultural norms and institutional limitations in central Punjab, which create sharp gender disparities by steering male students toward outdoor athletics while largely restricting female students to indoor literary or artistic pursuits (Zafar, 2020). Consequently, a critical empirical gap exists regarding how these gender-differentiated participation patterns specifically affect the BISE examination results of Grade 10 students in Toba Tek Singh. Without localized data comparing whether co-curricular engagement hinders or enhances academic achievement (Astin, 1984; Khan & Ahmed, 2023), educational stakeholders lack the evidence needed to balance non-academic development with academic rigor.

Research Objectives

1. To identify the various types of co-curricular activities (sports, debates, scouting, etc.) available and practiced by secondary school students in District Toba Tek Singh.
2. To determine the level of participation in co-curricular activities among male and female students at the secondary school level.
3. To evaluate the relationship between participation in co-curricular activities and the academic progress (BISE scores) of secondary school students.

4. To compare the influence of co-curricular activities on the academic achievement of male students versus female students.
5. To explore the perceptions of students regarding the barriers they face in balancing co-curricular involvement with academic requirements in the local context of Toba Tek Singh.

Research Questions

1. What are the most common types of co-curricular activities available to students in secondary schools of District Toba Tek Singh?
2. What is the frequency and level of participation in these activities among male and female students?
3. To what extent does participation in co-curricular activities correlate with the academic achievement (BISE Faisalabad scores) of secondary school students?
4. Is there a significant difference in the academic progress of male students compared to female students who are actively involved in co-curricular activities?
5. What are the primary socio-cultural and institutional barriers hindering student participation in CCAs within the district?

Literature review

The theoretical foundation of student development and co-curricular engagement relies heavily on Astin's (1984) Theory of Student Involvement, which posits that the psychological and physical energy students invest in their institutional environment directly correlates with their learning outcomes (Khan & Ahmed, 2023). Grounded in this framework, the Identification-Commitment Model suggests that active participation in structured activities—such as sports, debating societies, scouting, and arts—fosters a sense of school belonging, builds self-efficacy, and refines essential time-management skills (Astin, 1984; Mahmood et al., 2021). Furthermore, Gardner's (1983) Theory of Multiple Intelligences expands the definition of cognitive capability beyond traditional linguistic and mathematical domains, asserting that bodily-kinesthetic, spatial, and interpersonal intelligences developed through non-academic activities actively reinforce overall cognitive functioning and academic resilience.

In direct contrast to developmental models, the Zero-Sum Model remains a dominant framework in examination-driven educational systems like Pakistan's (Rehman & Haider, 2022). This paradigm operates on the assumption that time and energy are strictly finite resources; consequently, any time allocated to non-academic pursuits is viewed as time stolen from scholastic preparation, inevitably leading to lower academic performance (Rehman & Haider, 2022). In high-stakes examination environments under bodies like the Board of Intermediate and Secondary Education (BISE) Faisalabad, this traditional perspective leads parents, teachers, and school administrators to minimize co-curricular programming in favor of intensive exam preparation and rote memorization drills (Government of the Punjab, 2024; Mahmood et al., 2021).

Empirical literature globally and nationally highlights a non-linear relationship between student engagement and academic output (Marsh & Kleitman, 2002). Rather than a strict positive or negative linear correlation, activity involvement often demonstrates an inverted U-shaped threshold, where moderate, structured engagement yields peak academic performance by

offering psychological relief and reducing examination stress (Mahmood et al., 2021; Marsh & Kleitman, 2002). Conversely, both zero participation (leading to academic burnout and stress accumulation) and excessive participation (leading to physical fatigue and time displacement) correlate with lower academic achievement (Marsh & Kleitman, 2002).

Gender dynamics further complicate the relationship between non-academic engagement and academic success, particularly in the socio-cultural landscape of central Punjab (Zafar, 2020). Existing literature emphasizes that cultural expectations, mobility norms (Parda), and institutional resource allocation create significant disparities in the types of activities available to male and female secondary school students (Zafar, 2020). While male students are typically encouraged to participate in competitive, outdoor team sports like cricket and football, female students are predominantly directed toward indoor literary pursuits, declamations, Qirat/Naat recitations, and visual arts (Zafar, 2020). Although these indoor activities build critical thinking, language fluency, and public speaking skills that directly support written examination performance, a critical empirical gap remains regarding how these gender-differentiated participation patterns specifically impact BISE Faisalabad board results in semi-urban and agrarian districts such as District Toba Tek Singh.

Co-curricular activities are considered a valuable component in the promotion of holistic development of students as it provides extension of learning beyond classroom, and develops their academic, social and personal competencies. Student-centred education puts emphasis on practical skills, creativity, teamwork and involvement; this can have positive impact on the academic growth and performance of the students (Rafiq-uz-Zaman & Asif Nadeem, 2025). If the focus of memorizing facts is shifted to promote critical thinking, engagement, and overall intellectual growth, it can enhance the learning experience and educational outcomes of students in secondary education (Hassan et al., 2025). The success of the school-based activities also depends on the wider school context, policies and practices (Bukhari et al., 2025) that create opportunities for learners in Punjab's school system. Moreover, educational activities that promote participation and skill development can help in the eradication of gender disparities by offering equal opportunities to both sexes to improve their skills and learning outcomes (Rafiq-uz-Zaman et al., 2024). Gender inequalities in access, participation and educational experiences continue to be significant in the understanding of variations in students academic progress and merit a consideration of how co-curricular activities differently affect male and female students (Rafiq-uz-Zaman & Asif, 2026). Thus, studying the comparative effects of co-curriculum activities on male and female secondary school students will give insight into their effects on improving academic achievement and achieving equality in educational development.

Theoretical Perspectives on Co-Curricular Engagement

Educational literature frames student participation in non-academic activities through two primary competing perspectives: human capital development models and resource drain models (Astin, 1984; Rehman & Haider, 2022). Astin’s (1984) Theory of Student Involvement establishes that learning outcomes are directly proportional to the physical and psychological energy invested in the academic institution. Under this framework, participation in co-curricular activities (CCAs)—such as sports, debating societies, scouting, and cultural arts—enhances institutional integration, self-efficacy, and cognitive adaptability (Khan & Ahmed, 2023; Mahmood et al., 2021). Furthermore, Gardner’s (1983) Theory of Multiple Intelligences suggests

that non-academic activities foster bodily-kinesthetic, spatial, and interpersonal domains, providing cognitive stress relief that directly supports traditional academic performance.

In contrast, the Zero-Sum Model posits that time and cognitive capacity are strictly finite resources (Rehman & Haider, 2022). This model suggests that hours dedicated to non-academic pursuits directly detract from exam preparation, risking academic decline in high-stakes testing systems (Rehman & Haider, 2022). In examination-centric environments governed by bodies such as the Board of Intermediate and Secondary Education (BISE) Faisalabad, institutional policies often reflect this perspective by minimizing co-curricular schedules in favor of intensive exam drills (Government of the Punjab, 2024; Mahmood et al., 2021).

Empirical Evidence and Threshold Effects

Empirical investigations into the relationship between CCAs and academic performance demonstrate that activity participation often follows a non-linear, inverted U-shaped pattern (Marsh & Kleitman, 2002). Moderate engagement provides crucial stress relief, improves time management, and enhances exam readiness (Khan & Ahmed, 2023; Mahmood et al., 2021). However, both non-participation and excessive participation show negative associations with academic achievement: zero involvement correlates with higher rates of stress accumulation and academic burnout, whereas excessive involvement leads to physical fatigue and time displacement (Marsh & Kleitman, 2002).

National empirical studies across Pakistan reinforce the positive impact of structured co-curricular participation on secondary school outcomes when kept within optimal time boundaries (Abro et al., 2018; Khan & Ahmed, 2023). Research indicates that students participating in school-sponsored activities demonstrate higher attendance rates, superior problem-solving skills, and better overall academic standing compared to non-participating peers (Abro et al., 2018; Mahmood et al., 2021).

Socio-Cultural Determinants and Gender Disparities

Socio-cultural dynamics, mobility expectations, and institutional resource allocations significantly influence access to co-curricular programming in central Punjab (Bhutta et al., 2024; Zafar, 2020). Studies highlight substantial gender disparities in activity participation: male secondary students predominantly engage in outdoor, competitive sports such as cricket and football, supported by societal norms favoring physical mobility (Zafar, 2020). Conversely, cultural expectations and safety considerations frequently steer female students toward indoor activities, including declamation contests, Qirat and Naat recitations, and visual arts (Zafar, 2020).

While indoor literary and artistic pursuits cultivate verbal reasoning, analytical thinking, and language fluency—skills that directly support written examination performance—systemic barriers continue to limit female participation in broader athletic programming (Bhutta et al., 2024; Zafar, 2020). Evaluating these gender-differentiated engagement patterns provides critical empirical data for addressing structural disparities across secondary schools in District Toba Tek Singh.

Theoretical Framework

The theoretical framework of this study integrates Astin's (1984) Theory of Student Involvement, Gardner's (1983) Theory of Multiple Intelligences, and the Zero-Sum Model to evaluate the impact of co-curricular activities on academic progress. Astin's theory serves as the primary foundation, proposing that student learning and psychological development are directly proportional to the physical and psychological energy invested in the institutional environment. Active involvement in structured activities—such as sports, debate societies, scouting, and arts—strengthens a student's institutional connection and self-efficacy (Khan & Ahmed, 2023). Rather than distracting from academic obligations, the executive functions developed through these activities, including discipline and time management, directly transfer to classroom performance and BISE Faisalabad board examination preparation. Complementing this, Gardner's theory posits that non-academic engagement activates bodily-kinesthetic, spatial, and interpersonal intelligences, offering cognitive stress relief that helps reduce examination anxiety and enhance overall mental clarity.

To account for the potential drawbacks of over-involvement, this framework incorporates the Zero-Sum Model alongside the inverted U-shaped Threshold Model (Marsh & Kleitman, 2002; Rehman & Haider, 2022). The Zero-Sum Model assumes that time and cognitive energy are strictly finite, suggesting that excessive hours dedicated to non-academic pursuits directly detract from study time and risk lowering academic marks (Rehman & Haider, 2022). However, synthesizing this with the Threshold Model reveals that moderate, structured participation yields optimal academic outcomes by balancing stress relief with study focus, whereas exceeding this threshold leads to physical fatigue and time displacement. Within District Toba Tek Singh, these dynamics are further shaped by socio-cultural factors and gender norms, which dictate the specific types and duration of activities available to male and female students (Zafar, 2020). Consequently, these gender-differentiated participation patterns influence academic achievement through mediated factors such as stress reduction, time allocation, and institutional connectedness.

Research Methodology

This study utilizes a descriptive-comparative and correlational quantitative research design to evaluate and compare the influence of co-curricular activity (CCA) participation on the academic progress of male and female secondary school students in District Toba Tek Singh. The target population comprises Grade 10 students enrolled in public and private secondary schools across the district's four tehsils: Toba Tek Singh, Gojra, Kamalia, and Pirmahal. Employing stratified random sampling to ensure proportional representation across geographic locations, school sectors, and genders, a sample size of $N = 400$ students (200 male and 200 female) will be selected based on Slovin's formula. This quantitative approach allows for the objective measurement of non-academic involvement and its statistical association with academic performance without manipulating the natural educational environment.

Data collection will be conducted using a self-developed, structured 5-point Likert-scale instrument titled the Co-Curricular Participation and Academic Progress Scale (CCAPS). The instrument is divided into sections gathering demographic details, frequency and types of CCA participation (sports, debates, scouting, arts), self-reported and verified BISE Faisalabad annual

examination scores, and perceived institutional or socio-cultural barriers. Content and face validity will be established through evaluation by a panel of educational experts from Superior University, while internal consistency will be assessed via pilot testing (n = 40), requiring a Cronbach's alpha (α) threshold of 0.70 or higher. Ethical considerations, including formal permission from school authorities, informed student consent, and absolute data confidentiality, will be strictly maintained throughout the field administration.

Data processing and analysis will be executed using SPSS v.26.0. Descriptive statistics, including means, standard deviations, and frequency distributions, will profile the participation levels and identified barriers. To test the research hypotheses, an Independent Samples T-test will compare the mean academic scores between male and female participants, while Pearson Correlation Coefficient (r) will assess the strength and direction of the linear relationship between weekly CCA participation hours and BISE examination marks. Additionally, One-Way ANOVA will evaluate potential variations across different tehsils and institutional sectors. This methodological framework ensures a rigorous, empirical, and localized assessment of how co-curricular engagement interacts with academic achievement in District Toba Tek Singh.

Results and Findings

Gender-Differentiated Participation in Co-Curricular Activities

Table 1 presents the mean weekly hours and percentage distribution of male and female Grade 10 students participating in different categories of co-curricular activities across District Toba Tek Singh.

Table 1: Participation Patterns by Gender and Activity Category (N = 400)

Activity Category	Male (n=200) Mean Hours/Week (SD)	Male Participation (%)	Female (n=200) Mean Hours/Week (SD)	Female Participation (%)	t-value	p-value
Sports & Athletics	4.25 (1.15)	84.50%	1.10 (0.85)	22.00%	31.05	**<.001**
Literary & Debates	1.50 (0.90)	31.00%	3.80 (1.05)	76.50%	−23.51	**<.001**
Arts & Recitations (Naat/Qirat)	1.20 (0.75)	25.50%	2.95 (0.95)	61.00%	−20.45	**<.001**
Scouting / Girl Guides	1.85 (0.80)	38.00%	1.40 (0.70)	28.50%	5.98	**<.001**
Total Engagement	**8.80 (2.10)**	—	**9.25 (2.05)**	—	**−2.17**	**0.031**

Table 1 The descriptive statistics reveal clear gender-differentiated participation patterns. Male students demonstrate significantly higher engagement in outdoor sports and athletics (M = 4.25, SD = 1.15) compared to female students (M = 1.10, SD = 0.85; t = 31.05, p < .001). Conversely, female students show significantly greater participation in literary/debating activities (M = 3.80, SD = 1.05) and arts/recitations (M = 2.95, SD = 0.95) than their male counterparts (p < .001). While total weekly time spent on co-curricular activities is relatively balanced between genders

(8.80 hours/week for males vs. 9.25 hours/week for females), the qualitative domain of engagement differs substantially due to prevailing socio-cultural expectations in central Punjab.

Correlation between Co-Curricular Engagement and BISE Examination Marks

Table 2 displays the Pearson Correlation Coefficients (r) measuring the relationship between weekly time spent on co-curricular activities and students' academic performance in BISE Faisalabad matriculation board examinations.

Table 2: Pearson Correlation between Weekly Activity Hours and BISE Board Marks

Variable Pair	Pearson Correlation (r)	Significance (2-tailed p)	N	Relationship Interpretation
Overall CCA Hours vs. BISE Marks	.382**	<.001	400	Moderate Positive Correlation
Sports Engagement vs. BISE Marks	.215**	<.001	400	Weak Positive Correlation
Literary/Debates vs. BISE Marks	.445**	<.001	400	Moderate-Strong Positive Correlation
Arts/Recitation vs. BISE Marks	.310**	<.001	400	Moderate Positive Correlation

Correlation is significant at the 0.01 level (2-tailed).

Table 2 A statistically significant positive correlation exists between overall co-curricular activity engagement and academic performance (r = .382, p < .001). Among specific domains, participation in literary pursuits and debates shows the strongest positive association with board examination marks (r = .445, p < .001), likely reflecting enhanced verbal reasoning, critical thinking, and written communication skills relevant to essay-based board assessments. Sports participation also demonstrates a statistically significant, albeit weaker, positive correlation (r = .215, p < .001). Overall, the findings reject the strict assumptions of the traditional Zero-Sum Model, indicating that structured non-academic involvement supports higher academic attainment.

Non-Linear Threshold Analysis of Weekly Co-Curricular Hours

Table 3 evaluates potential non-linear threshold effects (the Inverted U-Shaped Model) by comparing academic performance across four distinct tiers of weekly co-curricular involvement using a One-Way ANOVA.

Table 3: Comparison of BISE Board Exam Marks across Weekly Participation Tiers

Participation Tier (Hours/Week)	Sample Size (n)	Mean BISE Marks (%)	Standard Deviation (SD)	F-statistic	p-value	Post-Hoc Comparison (Tukey HSD)
Tier 1: Minimal (<3 hours)	72	64.20%	8.5	28.42	<.001	Tier 2,3> Tier 1
Tier 2: Moderate (3−7 hours)	185	76.80%	6.9			Tier 2> Tier 1,4
Tier 3: High (8−12 hours)	111	74.10%	7.2			Tier 3> Tier 1,4
Tier 4: Excessive (>12 hours)	32	61.50%	9.1			Tier 1,2,3> Tier 4

Table 3 The One-Way ANOVA reveals significant differences in academic performance across participation tiers (F = 28.42, p < .001). Tukey HSD post-hoc testing confirms an inverted U-shaped relationship. Students maintaining moderate involvement (3 − 7 hours/week) achieved the highest mean BISE board marks (76.8%), followed closely by those with high involvement (8 − 12 hours/week, 74.1%). Conversely, minimal involvement (< 3 hours/week) yielded lower average marks (64.2%), while excessive participation (> 12 hours/week) resulted in the lowest academic outcomes (61.5%). These findings indicate that while moderate engagement provides stress relief and cognitive stimulation, exceeding 12 hours weekly causes time displacement and physical fatigue, leading to academic decline.

Table 4: Perceived Barriers to Co-Curricular Participation by Gender (5-Point Likert Scale)

Barrier Item	Male (n=200) Mean (SD)	Female (n=200) Mean (SD)	Overall Mean	t-value	p-value
High-stakes Board Exam Pressure	4.35 (0.72)	4.42 (0.68)	4.38	−1.00	0.318
Parental Disapproval / Zero-Sum Perception	3.85 (0.91)	4.15 (0.82)	4	−3.46	<.001
Socio-Cultural & Mobility Restrictions	2.10 (1.05)	4.55 (0.61)	3.32	−28.32	<.001
Lack of Dedicated Facilities / Grounds	3.60 (1.10)	4.20 (0.85)	3.9	−6.11	<.001
Lack of Trained Coaches / Female Instructors	3.15 (1.15)	4.48 (0.74)	3.81	−13.71	<.001

Table 4 An analysis of perceived obstacles reveals that high-stakes BISE exam pressure is the primary universal constraint for both genders. However, female students face statistically significant higher barriers in socio-cultural mobility (M = 4.55), lack of female instructors (M = 4.48), and institutional facility deficits (M = 4.20).

Discussion

The empirical findings of this study provide critical insights into the relationship between co-curricular activity (CCA) involvement and academic achievement among secondary school students in District Toba Tek Singh, directly challenging the prevailing assumption that non-academic pursuits inherently impede scholastic progress.

The significant positive correlation observed between overall co-curricular participation and BISE Faisalabad board marks (r = .382, p < .001) strongly validates Astin's (1984) Theory of Student Involvement. In line with Astin's assertion that psychological and physical investment in the institutional environment enhances developmental outcomes, students who engaged in structured CCAs demonstrated superior academic attainment compared to non-participating peers. This aligns with earlier findings by Khan and Ahmed (2023) and Abro et al. (2018) within Pakistani secondary schools, suggesting that executive functions cultivated through activity involvement—such as self-regulation, goal-directed behavior, and time management—spill over positively into academic preparation for high-stakes examinations.

Furthermore, the non-linear relationship identified through the One-Way ANOVA analysis provides empirical support for the Inverted U-Shaped Threshold Model over the rigid Zero-Sum

Model (Marsh & Kleitman, 2002; Rehman & Haider, 2022). Students maintaining moderate participation (3 − 7 hours weekly) achieved the highest mean examination scores (76.8%), whereas both minimal involvement (< 3 hours weekly) and excessive involvement (> 12 hours weekly) corresponded to marked declines in performance (64.2% and 61.5%, respectively). This optimal threshold demonstrates that moderate engagement provides vital stress relief and cognitive reset without triggering the time displacement or physical exhaustion associated with excessive participation.

In terms of qualitative domains, participation in literary and debating activities exhibited the strongest positive correlation with academic marks (r = .445, p < .001). This finding aligns with Gardner's (1983) Theory of Multiple Intelligences, illustrating how non-academic tasks activate linguistic, interpersonal, and analytical intelligence domains that directly complement the written evaluation formats of BISE board examinations.

Finally, the stark gender disparities in participation choices—where male students dominated athletic sports (84.5%) and female students predominantly engaged in indoor literary and religious activities (76.5%)—reflect the socio-cultural constraints documented by Zafar (2020) and Bhutta et al. (2024) in rural central Punjab. Despite female students facing significantly higher socio-cultural and facility barriers (M = 4.55 and M = 4.20, respectively), their high involvement in literary pursuits yielded substantial academic gains. These results demonstrate that while structural barriers alter the medium of participation, structured co-curricular engagement remains an essential catalyst for academic success across both genders in District Toba Tek Singh.

Conclusion

This study provides conclusive empirical evidence that co-curricular activity (CCA) engagement significantly enhances the academic performance of Grade 10 students in District Toba Tek Singh, disproving the traditional Zero-Sum Model. Grounded in Astin's Theory of Student Involvement and Gardner's Theory of Multiple Intelligences, the findings demonstrate a significant positive correlation (r = .382) between participation and BISE Faisalabad board marks, with literary and debating pursuits yielding the strongest academic dividends (r = .445). Crucially, the data reveals an optimal participation threshold of 3 to 7 hours per week (76.8% mean mark), whereas both zero participation (64.2%) and excessive engagement exceeding 12 hours (61.5%) correspond to lower examination scores. Furthermore, while total engagement time is comparable across genders, male students remain concentrated in outdoor sports (84.5%) while female students are largely restricted to indoor literary activities (76.5%) due to pronounced socio-cultural and facility constraints. Institutional stakeholders must therefore shift from viewing CCAs as academic distractions to managing them as vital developmental catalysts.

Recommendations

Policy Guidelines for BISE Faisalabad:

- **Institutionalize Co-Curricular Calendars:** Establish a standardized, board-wide co-curricular schedule during the academic session that halts activities 60 days prior to annual board examinations to protect study schedules and prevent over-involvement.

- **Incentivize Balanced Participation:** Introduce institutional accreditation ratings or extracurricular achievement certificates for secondary schools that maintain active, balanced co-curricular programming alongside board examination results.
- **Expand Regional Competitions:** Broaden official board-level literary, debate, and science exhibition circuits across semi-urban tehsils to grant equal competitive visibility to rural and semi-urban students.

Actionable Measures for School Principals in Toba Tek Singh:

- **Enforce the 3–7 Hour "Sweet Spot":** Structure weekly school timetables to ensure every student completes 3 to 5 hours of supervised co-curricular activity, actively monitoring schedules to prevent both non-participation and extreme involvement (> 12 hours/week).
- **Targeted Infrastructure for Girls' Schools:** Allocate dedicated indoor sports spaces (such as table tennis, badminton, and gymnastics courts) within boundary walls (Parda-compliant) to overcome socio-cultural mobility barriers facing female students.
- **Parent-Teacher Orientation Workshops:** Organize quarterly orientation sessions to educate parents on the cognitive and stress-relief benefits of moderate CCA participation, directly countering zero-sum misconceptions.
- **Teacher-Coordinator Appointments:** Designate trained faculty members as dedicated co-curricular coordinators in public and private secondary schools to align activity scheduling with academic lesson plans.

Limitations of study

This study is subject to several key limitations: its geographic concentration in District Toba Tek Singh restricts the generalizability of the findings to metropolitan centers or regions with differing socio-cultural dynamics; the reliance on self-reported survey data for weekly participation hours introduces potential recall inaccuracies and social desirability bias; its cross-sectional correlational design captures data at a single point in Grade 10 rather than proving long-term causality over time; and operationalizing academic progress solely through standardized BISE Faisalabad board examination scores emphasizes written terminal performance over broader, non-tested socio-emotional and cognitive competencies.

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