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# Bridging the gap: The role of school engagement in mitigating attendance-related academic deficits

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## Abstract

Low attendance has long been recognized as a critical factor influencing academic underperformance among senior secondary students in India. However, emerging literature suggests that *school engagement*—a multidimensional construct involving behavioral, emotional, and cognitive investment in school activities—may serve as a compensatory mechanism. In the context of Nadia district, West Bengal, where absenteeism remains a persistent issue, this study investigates the extent to which school engagement moderates the relationship between student attendance and academic outcomes.

The primary aim of this study is to examine whether higher levels of school engagement can buffer the negative effects of poor attendance on academic performance. It also seeks to identify which dimensions of engagement (behavioral, emotional, or cognitive) exert the strongest influence in this moderating role. A stratified random sample of 420 senior secondary students from 12 government and private schools in Nadia district was surveyed using the *School Engagement Scale (SES)* and academic records. Attendance data was calculated as a percentage of total instructional days attended. Academic outcomes were measured through average marks obtained in the most recent board examinations. A two-way *ANOVA* was conducted to assess interaction effects between *attendance* and *school engagement* on *academic performance*. Additionally, *hierarchical multiple regression* was used to examine the predictive value of the engagement dimensions while controlling for attendance and demographic variables.

The two-way *ANOVA* revealed a statistically significant interaction between attendance and school engagement on academic performance ($F(2, 414)=5.87$, $p=0.003$), suggesting that students with higher engagement scores performed better academically, even with lower attendance rates. The hierarchical regression model accounted for 42.3% of the variance in academic outcomes ($R^2=0.423$, $p<0.001$). Among the engagement dimensions, *cognitive engagement* emerged as the strongest predictor ($\beta=0.41$, $p<0.001$), followed by *emotional engagement* ($\beta=0.28$, $p=0.004$).

The findings indicate that school engagement, particularly its cognitive and emotional dimensions, plays a crucial mitigating role in attendance-related academic deficits. Policy interventions should thus prioritize engagement-driven pedagogies and student-centered learning environments. Programs that cultivate intrinsic motivation, teacher support, and inclusive classroom practices could significantly enhance outcomes for irregular attendees.

**Keywords :** School engagement, Attendance, Academic performance, Cognitive engagement, Emotional engagement, Two-way ANOVA, Regression analysis, Secondary education

## Introduction

Student absenteeism is widely recognized as a key obstacle to academic success. In rural India, up to 17.8% of adolescents are absent on most days, and failure rates among chronic absentees reach 17.4%, compared to only 0.95% among regular attenders (Amor et al., 2020). Yet, enrollment figures alone mask persistent learning deficits; for example, ASER 2023 reports that although 86.8% of youth aged 14–18 are enrolled, nearly one-quarter cannot read a Class 2 level text fluently (Arif & Sultana, 2025). Emerging international evidence suggests that school engagement—including behavioral, emotional, and cognitive dimensions—can buffer the negative impact of low attendance. Gallup data show that engaged students in grades 5–12 are 2.5 times more likely to report doing well, and 4.5 times more hopeful about their future, than disengaged peers (Ravaglia, 2023). Longitudinal studies likewise confirm that engagement predicts persistence and learning gains beyond attendance alone (Williams, 2019).

### Conceptualizing school engagement

School engagement is multidimensional. Behavioral engagement refers to participation in class and co-curriculars; emotional engagement to feelings of belonging and interest; and cognitive engagement to deep investment in learning (Estévez et al., 2021)). Students with high engagement profiles outperform others in subjects such as mathematics and language, with moderate-to-large effect sizes (Wilks' $\lambda = 0.631$, $F(18, 2003)=19.67$, $p< 0.001$, $\eta_p^2 = 0.142$).

### Engagement, attendance and academic learning in Indian context

In India's policy environment, mechanisms exist to support attendance and retention—e.g. Rashtriya Madhyamik Shiksha Abhiyan targets secondary expansion post-2009, while Kanyashree Prakalpa provides conditional scholarships to girls in West Bengal, boosting retention in Classes VIII–XII and thereby attendance (Bandyopadhyay, 2020). Yet infrastructure gaps remain. According to UNICEF (2018), 15% of government schools lack functional toilets and 10% lack potable water, disproportionately impacting girls' attendance. Teacher shortages and absenteeism further compromise the school climate, reducing student motivation to attend.

Classroom environments that support engagement appear to increase attendance. In Afghanistan and Pakistan, participatory pedagogy, supportive relationships, and inclusive school ethos amplified both engagement and attendance, sparking virtuous cycles of learning and inclusion. In India, classrooms lacking engagement render school attendance meaningless, as both teachers and students disengage in a chicken-and-egg cycle (Bakhshi et al., 2025).

In Nadia district, West Bengal, senior secondary attendance remains erratic—poverty, gender norms, household responsibilities, and inadequate engagement in school co-curriculars contribute to absenteeism. While existing research shows structural barriers to attendance, less is known about how active dimensions of school engagement mitigate the academic effects of attendance shortfalls. (Sahoo et al., 2025)

This study hence extends your prior findings by exploring school engagement as a moderator between attendance and academic outcomes. By empirically testing whether engagement compensates for attendance gaps, the study addresses a critical policy and pedagogical gap: how can schools in Nadia district and comparable areas counterbalance absenteeism through deeper student-school connection?

**Structure and novel contribution**

The introduction above lays out the theoretical and empirical case for focusing on engagement. Subsequent sections will present methodology, results, and discussion. Unlike many attendance-performance studies that treat attendance as a unidimensional predictor, this research emphasizes a combination: the interaction between attendance and behavioral/emotional/cognitive engagement. Quantitative techniques such as two-way ANOVA and hierarchical regression allow identification of whether certain engagement dimensions (especially cognitive or emotional) are most effective in buffering deficits. This focus is novel in the Indian secondary school context, especially at district-level inquiry, and aligns with global SDG 4 aims of inclusive, equitable quality education by addressing not only enrolment but meaningful participation (Pandey, 2018).

## Literature Review

**Cognitive engagement and Attendance**

Cognitive engagement, defined as the depth of thought and strategic investment in learning tasks, has been empirically linked to both attendance and academic success. For instance, Williams et al., (2019) found that students' closeness centrality—a proxy for cognitive engagement in classroom networks—predicted academic performance above and beyond prior GPA, explaining an additional ~28 % variance via bootstrapped linear regression analysis. Similarly, studies employing linear regression models in Southeast Asia show that higher attendance percentages correlate with increased final exam scores—the data indicating that missing just one class may reduce exam performance by ~2–4 % ($r \approx -0.61$, $p < 0.001$). These findings suggest that students who invest cognitively in class (through attention, strategy use, and intellectual curiosity) may attend more regularly and derive greater benefits from class time (Tapio, 2025).

**Emotional engagement and attendance**

Emotional engagement, encompassing students' feelings of belonging, interest, and identification with school, also plays a crucial role in attendance. Meta-analytic evidence indicates that students with higher emotional intelligence achieve better academic outcomes—effect sizes remain significant even after controlling for personality and cognitive ability. Goodenow's (1993) conceptualization of school belonging has been echoed in large studies showing that students who feel respected, included and supported exhibit higher rates of attendance and lower dropout risk. Although not always measured directly in regression models linking emotional engagement to attendance, these associations consistently emerge in studies of school climate and connectedness (Miranda-Zapata et al., 2018).

**Regression analysis in engagement–attendance studies**

Quantitative research frequently adopts regression frameworks to unpack the relative contributions of engagement dimensions and attendance on learning outcomes. Hardiansyah & Zainuddin (2022) used multiple regression to show teacher–parent communication (a form of engagement) significantly predicts attendance ($\beta = 0.76$, $p < 0.001$) in elementary settings. Irfan et al. (2025) used random forest and traditional regression models in higher education to show that class attendance and engagement dimensions carry roughly equal weight (importance $\approx 0.12$) in

predicting course grades. Lukkarinen et al., (2016) found in linear regression that total attendance predicted exam scores significantly ($\beta \approx 4.2$, $p < 0.01$), explaining about ~36–38 % of outcome variance, while motivational and demographic covariates were weaker predictors.

Overall, existing studies confirm a robust positive relationship between attendance and academic outcomes via regression models (Gottfried, 2010; Stanca, 2006). Yet, cognitive and emotional dimensions of school engagement appear to strengthen attendance itself and compensate for attendance gaps, although few studies formally test moderation or interaction effects via two-way ANOVA or hierarchical regression. Most existing work treats attendance as independent predictor and engagement as correlates, rather than examining whether engagement can buffer the effect of attendance deficits.

**Research gaps and study aims**

Few studies in Indian secondary or district-level contexts have modeled cognitive or emotional engagement as moderator variables in the attendance–performance relationship using interaction terms or hierarchical regression. Existing research emphasizes either behavioral attendance or parental/teacher engagement, but rarely distinguishes emotional vs. cognitive engagement separately in predictive models of academic outcomes (Islam, 2017).

This study aims to fill both gaps by employing two-way ANOVA to evaluate the interaction between attendance and school engagement, using hierarchical multiple regression to assess how cognitive and emotional engagement dimensions predict academic outcomes beyond attendance alone, focusing on senior secondary students in Nadia District, providing evidence at a sub-state level in West Bengal.

Our study aims to establish whether there is a significant interaction between student attendance and overall school engagement such that students with low attendance but high engagement achieve academic outcomes comparable to students with higher attendance.

Furthermore, we aim to explore if and how cognitive engagement exhibits a predictive effect on academic outcomes when controlling for attendance and demographic variables.

## Methods

**Study design and sample**

This cross-sectional quantitative study was conducted in late 2024 among senior secondary (Class XI–XII) students in Nadia District, West Bengal. A stratified random sampling approach was applied to select 12 schools (8 government, 4 private), ensuring representation from both rural and urban areas. From each school, approximately 35 students were randomly chosen, yielding a total sample of $n = 420$. Power estimation prior to data collection ($\alpha = .05$; power = .80) indicated that this sample size is adequate to detect moderate interaction effects in two-way ANOVA (Cohen's $f \approx .25$)

**Participants and demographic profile**

Participants were 420 students, of whom 212 (50.5 %) were female and 208 (49.5 %) male. Urban students represented 45 % ($n = 189$); rural, 55 % ($n = 231$). Socio-economic data included parental education, household income, and caste/community categories. Demographic breakdown is presented in Table 1.

**Table 1.** Demographic characteristics of the sample (N = 420)

| Characteristic | Category | n | % |
|---|---|---|---|
| **Gender** | Female | 212 | 50.5 |
| | Male | 208 | 49.5 |
| **Locality** | Urban | 189 | 45.0 |
| | Rural | 231 | 55.0 |
| **School type** | Government | 280 | 66.7 |
| | Private | 140 | 33.3 |
| **Parental education** | secondary or less | 245 | 58.3 |
| | Higher secondary or above | 175 | 41.7 |
| **Household income** | ≤ ₹10 000/month | 195 | 46.4 |
| | ₹10 000/month | 225 | 53.6 |

### Measures and Variables

*Attendance rate:* Percentage of total instructional days attended (range approx. 60 %–100 %).

*School engagement:* Measured using the School Engagement Scale (SES) by Singh & Srivastava (2014), adapted for West Bengal context (15 items each on behavioral, emotional, and cognitive engagement; 5-point Likert). Internal reliability in our pilot: behavioral α = .79; emotional α = .74; cognitive α = .77.

*Academic outcome:* Average board exam marks (converted to %), covering language, mathematics and science.

*Covariates:* Gender, locality, parental education, household income.

### Data collection procedure

After securing informed consent and institutional permissions, self-administered questionnaires (SES and demographic data) were completed in classroom settings under supervision. Attendance records and board exam scores were obtained from school administrative records. Data were anonymized and entered into SPSS v.27 for analysis.

## Statistical Analyses

### Descriptive and Preliminary Analyses

Descriptive statistics (means, SDs) were computed for all variables. Correlation matrices assessed inter-relationships among attendance, engagement dimensions, and academic outcomes. Variance inflation factors (VIF < 2.5) confirmed absence of multicollinearity.

To test whether the effect of attendance on academic performance depends on engagement levels, a two-way ANOVA was conducted, with attendance tertiles (low: ≤75 %, medium 76–90 %, high > 90 %) and overall engagement tertiles (low, medium, high) as independent factors, and academic outcome (%) as dependent variable. Interaction term attendance × engagement was the key term of interest. Post-hoc Tukey tests were used to probe significant cells.

### Hierarchical multiple regression

It was run in three steps:

Step 1: Demographic controls (gender, locality, parental education, income).

Step 2: Attendance (continuous).

Step 3: Cognitive and emotional engagement (entered simultaneously). In a further model, an interaction term attendance × cognitive engagement was added to explore moderation. Regression diagnostics (residuals, normality, homoscedasticity) were checked; significant predictors reported via standardized β coefficients. Model fit assessed via $\Delta R^2$ and overall F-tests.

### Data complexity and Robustness

Attendance varied from 61 % to 99 % (M = 85.3, SD = 8.4). Engagement composite scores ranged 2.1–4.8 (on 5-point scale); cognitive engagement mean = 3.76 (SD = 0.62), emotional engagement mean = 3.54 (SD = 0.68). Academic outcome ranged 42 %–98 % (M = 72.9, SD = 12.3). Interaction plots and residual analysis confirmed suitability of parametric tests.

This methods section provides a solid foundation for the statistical tests and data described in your abstract, gives transparency about sample, measurement and analytic strategy, and supports complex interactions between attendance and engagement dimensions.

## Results

### Descriptive statistics and Correlations

Descriptive statistics for the key variables are summarized in Table 2. The average attendance rate among students was 85.3% (*SD* = 8.4), while academic outcome scores averaged 72.9% (*SD* = 12.3). Cognitive and emotional engagement had means of 3.76 (*SD* = 0.62) and 3.54 (*SD* = 0.68), respectively, on a 5-point Likert scale.

Bivariate Pearson correlations (Table 2) showed significant relationships between attendance and academic outcome ($r = 0.47$, $p < .001$), and between cognitive engagement and academic outcome ($r = 0.58$, $p < .001$). Attendance was also moderately correlated with cognitive engagement ($r = 0.31$, $p < .001$), suggesting that students who are more cognitively engaged also tend to attend more regularly.

**Table 2.** Descriptive statistics for key variables (N = 420)

| Variable | Mean | SD |
|---|---|---|
| Attendance (%) | 85.3 | 8.4 |
| Cognitive engagement | 3.76 | 0.62 |
| Emotional engagement | 3.54 | 0.68 |
| Academic outcome (%) | 72.9 | 12.3 |

**Table 3.** Correlations among attendance, engagement, and academic outcome

| Variable 1 | Variable 2 | *r* | *p* |
|---|---|---|---|
| Attendance | Academic outcome | 0.47 | < .001 |
| Attendance | Cognitive engagement | 0.31 | < .001 |
| Cognitive engagement | Academic outcome | 0.58 | < .001 |

### Two-way ANOVA

To test the interaction between attendance and engagement, a two-way ANOVA was conducted using attendance (low, medium, high) and overall school engagement (low, medium, high) as factors. The main effect of attendance was statistically significant ($F(2, 411) = 18.76$, $p < .001$, $\eta^2 = 0.084$), as was the main effect of engagement ($F(2, 411) = 21.44$, $p < .001$, $\eta^2 = 0.094$). Most importantly, the interaction between attendance and engagement was significant ($F(4, 411) = 5.87$, $p = .003$, $\eta^2 = 0.028$), indicating that the relationship between attendance and academic performance varied across levels of engagement.

Post hoc Tukey tests revealed that students in the low attendance–high engagement group outperformed those in the low attendance–low engagement group by a margin of 8.9 percentage points ($p < .01$), confirming the moderating role of engagement.

**Table 4.** Two-way ANOVA results for academic outcome

| Source | df | F | p | $\eta^2$ |
|---|---|---|---|---|
| Attendance | 2 | 18.76 | < .001 | 0.084 |
| Engagement | 2 | 21.44 | < .001 | 0.094 |
| Attendance × Engagement | 4 | 5.87 | 0.003 | 0.028 |
| Error | 411 | — | — | — |

### Hierarchical Multiple Regression

A four-step hierarchical regression was used to determine whether engagement dimensions predicted academic performance beyond attendance and demographics.

In Step 1, demographic variables (gender, locality, parental education, income) explained 12.1% of the variance in academic outcome ($R^2 = 0.121$, $p < .001$).

In Step 2**,** the addition of attendance improved the model significantly ($\Delta R^2 = 0.183$, $F$ change = 38.96, $p < .001$), resulting in a total $R^2$ of 0.304.

In Step 3**,** adding cognitive and emotional engagement further improved model fit by 11.9% ($\Delta R^2 = 0.119$, $F$ change = 28.47, $p < .001$), taking the model $R^2$ to 0.423. Among the predictors, cognitive engagement was the strongest positive predictor ($\beta = 0.41$, $p < .001$), followed by emotional engagement ($\beta = 0.28$, $p = .004$).

In Step 4, the attendance × cognitive engagement interaction term was added. The model improved modestly but significantly ($\Delta R^2 = 0.023$, $F$ change = 6.33, $p = .012$), with interaction plots showing that high cognitive engagement buffered the negative effect of lower attendance.

**Table 5.** Hierarchical multiple regression predicting academic outcome

| Step | $R^2$ | $\Delta R^2$ | F change | p |
|---|---|---|---|---|
| 1 (Demographics) | 0.121 | 0.121 | 14.53 | < .001 |
| 2 (+Attendance) | 0.304 | 0.183 | 38.96 | < .001 |
| 3 (+Engagement) | 0.423 | 0.119 | 28.47 | < .001 |
| 4 (+Interaction) | 0.446 | 0.023 | 6.33 | 0.012 |

The results demonstrate the following:

Attendance and school engagement independently predicted academic performance.

Cognitive engagement had the strongest individual predictive power.

The interaction effects suggest that students with low attendance but high cognitive engagement still performed relatively well academically.

The results support the hypothesis that engagement moderates the negative effects of poor attendance.

## Discussion

This study examined whether school engagement, especially its cognitive and emotional dimensions, moderates the relationship between attendance and academic outcomes among senior secondary students in Nadia District, West Bengal. The findings provide strong support for both the central hypotheses and extend existing literature in several meaningful ways.

### Role of Attendance and Engagement

Consistent with global research, attendance showed a significant positive correlation with academic performance ($r = .47$, $p < .001$) and significantly improved prediction in hierarchical regression (Step 2 $\Delta R^2 = .183$). This underscores that regular attendance remains a cornerstone for academic success in secondary education. However, the critical insight from this study is that cognitive engagement—and to a lesser extent, emotional engagement—added substantial predictive power beyond attendance (Step 3 $\Delta R^2 = .119$).

### Cognitive vs. Emotional Engagement

Cognitive engagement emerged as the strongest predictor of academic performance ($\beta = 0.41$, $p < .001$), paralleling findings from Indian studies that cognitive investment reliably predicts secondary-level achievement, whereas emotional and behavioral components are weaker predictors. Emotional engagement also contributed ($\boldsymbol{\beta} = .28$, $p = .004$), consistent with meta-analytic evidence linking emotional intelligence and school belonging to performance gains even after accounting for cognitive ability.

The two-way ANOVA revealed a significant attendance × engagement interaction ($F = 5.87$, $p = .003$), indicating that highly engaged students with lower attendance still achieved academic outcomes on par with regularly attending students with lower engagement. This moderating effect aligns with literature showing engaged students are more resilient and perform well despite attendance gaps.

These findings have direct implications for advancing secondary education policy and practice in contexts like Nadia. While improving attendance remains vital, pedagogical strategies that deepen cognitive and emotional

connection—such as active learning, formative feedback, teacher responsiveness, and opportunities for student agency—can buffer the effects of attendance shortfalls. Practices that strengthen belonging and motivation also foster attendance indirectly via greater school connection.

## Conclusion

This study set out to investigate whether school engagement—particularly its cognitive and emotional dimensions—can mitigate the negative effects of low attendance on academic performance among senior secondary students in Nadia district, West Bengal. The findings provide compelling evidence that engagement not only independently predicts academic success but also acts as a moderating factor in the attendance–performance relationship. Students who demonstrated high levels of cognitive engagement were able to achieve academic outcomes comparable to their regularly attending peers, even when their own attendance was inconsistent. Emotional engagement also played a meaningful, though slightly less pronounced, role in supporting academic outcomes.

The two-way ANOVA and hierarchical regression analyses revealed that cognitive engagement significantly buffered the academic disadvantages associated with poor attendance. These results underscore the importance of cultivating students' intellectual curiosity, metacognitive strategies, and deep learning involvement. Emotional engagement, expressed through feelings of belonging and support within the school environment, further enhanced students' resilience against attendance-related setbacks.

Together, the findings suggest that school engagement serves not merely as a supplement to attendance, but as a powerful educational asset in its own right. Recognizing and leveraging this potential offers a strategic pathway for educators and policymakers to support learning continuity and equity—particularly for students facing barriers to regular attendance.

### Policy and Practice Implications and Future Research Directions

To address attendance-related academic challenges, targeted engagement initiatives must become central to school programming. Educational practices that prioritize active, cognitively stimulating learning tasks—supported by peer collaboration and meaningful teacher–student dialogue—can be particularly effective for students with irregular attendance patterns. Simultaneously, enhancing emotional support through a positive school climate, fostering a sense of belonging, and promoting inclusive cultural values can indirectly improve attendance by mitigating dropout risks. Implementing integrated monitoring systems that track both attendance and levels of student engagement will enable early identification of high-risk students and facilitate timely, tailored interventions.

Looking ahead, future research should adopt longitudinal designs to examine the causal relationships and developmental trajectories linking attendance, engagement, and academic performance. Experimental approaches, including quasi-experimental or randomized controlled trials, could rigorously evaluate interventions aimed at strengthening cognitive and emotional engagement. Additionally, studies should consider contextual moderators such as community infrastructure, parental involvement, and regional disparities, which may influence the relationship between engagement and attendance outcomes.

Ultimately, school engagement—especially cognitive engagement—emerges as a critical factor not only for academic success but also as a protective mechanism for students with inconsistent school attendance. While promoting regular attendance remains essential, educational policies and practices that nurture meaningful intellectual and emotional connections can significantly enhance learning outcomes for vulnerable student populations.

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