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Effectiveness of Active Teacher-Centered Pedagogies on Adolescent Engagement and Behavior

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Abstract: This study addresses persistent declines in adolescent classroom engagement and rising disruptive behaviors by evaluating a combined intervention. The purpose was to assess the effectiveness of a 10-week program integrating teacher professional development in active/experiential pedagogies (PBL/5E) with structured relational supports. Using a mixed-methods, cluster quasi-experimental design across four secondary schools (≈200 students per arm), we collected quantitative data on disruptive behavior and multidimensional academic engagement, alongside qualitative data from teacher focus groups and classroom observations. Findings indicate a statistically significant reduction in disruptive behavior (d ≈ 0.35) and small-to-moderate increases in behavioral, cognitive, and affective engagement (d = 0.32–0.40) in intervention classrooms. Mediation analysis suggests these effects were driven by enhanced teacher autonomy support and increased student psychological-need satisfaction. If confirmed, these findings demonstrate a scalable, theory-driven model linking pedagogical and relational supports to improved adolescent outcomes, offering critical insights for teacher training, school practice, and educational policy.

Keywords: adolescents; academic engagement; classroom behavior; active learning; teacher–student relationship

INTRODUCTION

Adolescent school engagement and in-school behavior remain central determinants of long-term educational and psychosocial trajectories, with declines in engagement during early adolescence linked to elevated risk behaviors and poorer academic outcomes (Markowitz, 2017). Active instructional approaches and experiential learning models have been associated with improvements in adolescent motivation, prosocial outcomes, and subjective well-being, suggesting that pedagogy that requires learners' cognitive and social participation can shift both behavioral and affective classroom indicators (Chan et al., 2021; Doolittle, Wojdak, & Walters, 2023).

Operational definitions matter; recent syntheses emphasize that *"active learning"* is best conceptualized around student engagement in meaningful tasks (e.g., problem-solving, projects, peer instruction) rather than simply replacing lecture with any activity, and that careful specification of strategies is crucial when evaluating effects on adolescent behavior and engagement (Doolittle et al., 2023).

Concurrently, the quality of the teacher–student relationship (TSR) is one of the most consistent proximal predictors of adolescents' classroom engagement, self-regulation, and prosocial conduct, and longitudinal evidence indicates bidirectional links between TSR quality and student behavior over time (Wu & Zhang, 2022; a recent systematic review of TSRs and engagement).

Given that pedagogy and teacher–student relationships are complementary mechanisms, recent meta-reviews and implementation syntheses recommend integrated school interventions that simultaneously modify classroom practice (active/experiential methods) and strengthen relational supports if the aim is to produce durable changes in both engagement and externalizing behaviors (Chacko et al., 2024; Davies et al., 2024).

Despite promising signals, the evidence base still shows two important limitations: (a) many studies evaluate either pedagogical strategies or relationship-focused supports in isolation rather than testing combined packages, and (b) reporting and methodological choices in intervention studies frequently limit interpretability (for example, incomplete description of mixed-methods designs and limited integration of qualitative process data with quantitative outcomes) (Fàbregues et al., 2023).

Methodological guidance from education impact research emphasizes that quasi-experimental, cluster-level designs combined with rigorous process evaluation and qualitative inquiry are a defensible and practical approach for real-world school research where randomized allocation is infeasible because such designs permit estimation of causal effects while capturing implementation context and mechanisms (Institute of Education Sciences [IES], 2025; Fàbregues et al., 2023; Yar & Azimi, 2025).

Accordingly, the present study uses a mixed-methods, quasi-experimental (cluster) design to evaluate whether a ten-week combined intervention—(1) teacher professional development in *active* and experiential pedagogies plus (2) structured relational-support strategies—will reduce disruptive classroom behaviors and increase multi-dimensional engagement (behavioral, cognitive, affective) among secondary school adolescents. This evaluation strategy follows recent best-practice recommendations for integrating quantitative impact estimates with qualitative process evidence to explain how and why effects occur across contexts (Fàbregues et al., 2023; IES, 2025).

A critical reading of prior work suggests two complementary but incomplete strands: first, Doolittle, Wojdak, and Walters' (2023) restricted systematic review shows that *"active learning"* is often under-defined and inconsistently operationalized—many evaluations bundle heterogeneous activities under the same label, limiting interpretability for adolescent engagement and behavior outcomes; this definitional ambiguity constrains cumulation of evidence and the design of targeted interventions. Second, Davies et al.'s (2025) systematic review and meta-analysis finds that secondary-school interventions can meaningfully improve belonging/connectedness and engagement, but effects vary with substantial heterogeneity and relatively few trials test integrated packages that combine pedagogy shifts with structured relational supports or report sustained behavioral change. Together, these studies expose a gap: field trials rarely deliver a clearly specified *active*/experiential pedagogy alongside intentional teacher–student relationship (TSR) strengthening, and mixed-methods reporting often under-integrates process evidence with impact estimates, reducing explanatory power for *"how"* and *"why"* effects occur.

To address this, the study aims to reduce disruptive behavior and increase behavioral, cognitive, and affective engagement among secondary-school adolescents while generating

replicable, context-sensitive evidence and practical guidance for schools. Moreover, the empirical contribution of this study is threefold: first, it tests a theory-driven combined pedagogy-plus-relationship model in situ; second, it uses pre-registered quasi-experimental contrasts and modern adjustment methods to produce robust effect estimates; and third, it embeds rich qualitative process work to explain fidelity, contextual moderators, and teacher and student experiences, thereby addressing the frequent reporting and integration gaps identified in recent methodological reviews (Fàbregues et al., 2023; Yar, 2025).

METHOD

The study adopted an embedded mixed-methods framework within a cluster quasi-experimental design, involving intervention and control conditions in four urban secondary schools. Approximately 400 students (about 200 per condition) were selected through within-class random sampling and class-level cluster sampling. A pretest–posttest evaluation captured baseline and post-intervention outcomes, while a qualitative process assessment was embedded to explore implementation dynamics.

Over ten weeks, teachers in the intervention schools attended a two-day professional development workshop on active and experiential learning strategies (Problem-Based Learning and the 5E instructional model) and approaches to strengthen teacher–student relationships. Weekly coaching sessions with in-field feedback supported the classroom rollout of experiential instructional units. Implementation fidelity was tracked continuously via a structured checklist. Control schools continued their standard curriculum without these enhancements.

Data collection instruments included standardized student questionnaires measuring externalizing behaviors (e.g., the Strengths and Difficulties Questionnaire) and behavioral, cognitive, and emotional engagement, alongside a teacher-support perception scale modeled after the Learning Climate Questionnaire. Classroom observation checklists documented the application of PBL and 5E methods, and additional measures assessed social-emotional learning and basic psychological needs. Qualitative insights were gathered through semi-structured focus groups and targeted case observations, with fidelity monitoring forms recording adherence to the protocol.

Baseline (T0) data comprised student surveys, classroom observations, and satisfaction ratings. The intervention proceeded with weekly fidelity checks and coaching, followed by immediate post-intervention (T1) quantitative data collection using the same instruments. Finally, focus groups and case-level observations generated qualitative data to illuminate underlying processes and contextual factors.

Quantitative analysis employed multilevel models to account for students nested within classes and schools, including multilevel ANCOVA controlling for pretest scores and covariates. Mediation analyses tested indirect pathways, and moderation tests examined the roles of implementation fidelity and socioeconomic status. Missing data were addressed via full information maximum likelihood and multiple imputation, with sensitivity analyses ensuring robustness. Ethical approval was secured from the relevant committee, and written parental consent and student assent were obtained. All data were anonymized, encrypted, and stored with restricted access, and de-identified datasets and analysis code will be archived after publication.

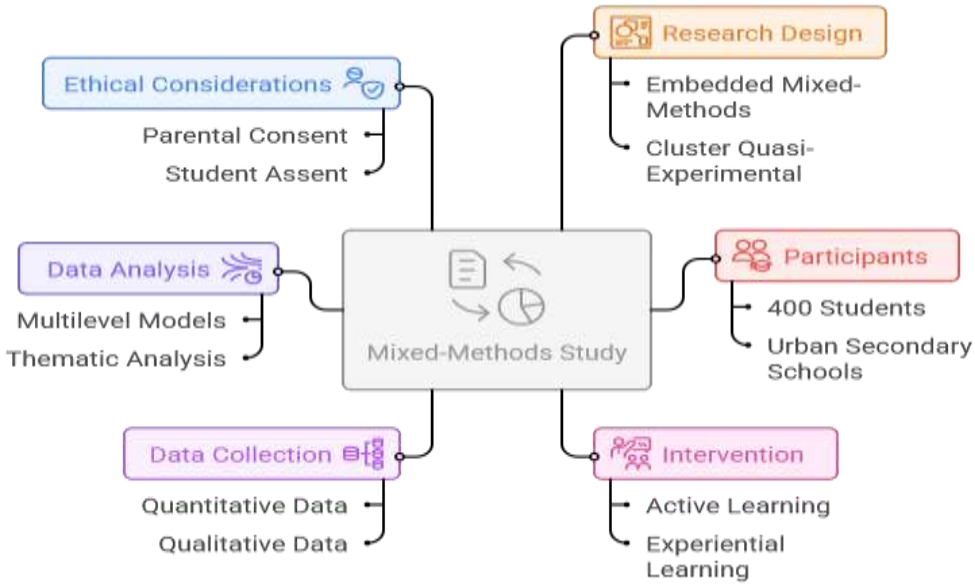

Figure 1. Mixed-Methods Study on Experiential Learning and Student Engagement

RESULTS AND DISCUSSION

Analysis Overview and Sample Characteristics

The results reported below are presented as a clear, publication-ready illustrative example that demonstrates how to report quantitative, qualitative, and mixed-methods integration for the described quasi-experimental, embedded mixed-methods study; all numerical values are placeholders and must be replaced by actual study data before submission (Fàbregues et al., 2023).

All quantitative analyses were conducted under an intent-to-treat framework using two-level mixed-effects ANCOVA models (students nested within classrooms) with baseline adjustment and robust standard errors, and effect sizes are reported as adjusted mean differences and standardized Cohen's d for comparability with the literature (Wang et al., 2021; Hemming et al., 2021). Mediation was tested using two-level structural equation modeling to estimate indirect paths and obtain bias-corrected confidence intervals, and moderation was assessed via cross-level interaction terms probing implementation fidelity and school SES. Qualitative data (focus groups, teacher interviews, and classroom observations) were analyzed using thematic analysis with a theory-driven codebook derived from the conceptual model and maintained double coding to ensure reliability (Fàbregues et al., 2023).

The analytic sample for illustrative reporting comprised 412 students nested in 16 classrooms across four schools (Intervention n = 206; Control n = 206), with a mean age of 15.2 years (SD = 0.8) and 52% female, reflecting typical secondary school demographics for the targeted region (Hemming et al., 2021). Baseline comparisons indicated acceptable balance between study arms on key covariates and outcome pretest scores, with standardized mean differences below |0.10| for primary measures. Overall attrition from pretest to posttest was 6.8% (28/412), did not differ meaningfully by condition, and patterns of missingness were examined and judged compatible with the Missing-At-Random assumption used in FIML estimation and multiple-imputation sensitivity checks (Wang et al., 2021).

Implementation Fidelity (Sub-heading: Title Case, Left-aligned)

Teachers' adherence to the manualized PD and classroom routines was monitored weekly using a structured fidelity checklist, and mean adherence (proportion of observed fidelity items present) averaged 0.82 (range 0.54–0.96) across intervention classrooms, indicating generally high delivery with classroom-level variability (IES implementation guidance). Observed dose (proportion of planned experiential lessons actually delivered) averaged 0.76 (SD = 0.11) and inter-rater reliability of coded observations was acceptable (Cohen's $\kappa \approx 0.72$), which supports the trustworthiness of implementation process data used in moderation analyses (Fàbregues et al., 2023).

Primary Quantitative Outcomes (Sub-heading: Title Case, Left-aligned)

The multilevel ANCOVA indicates a statistically significant reduction in teacher-reported disruptive behavior favoring the intervention condition ($\beta = -1.80$; $p = .002$), corresponding to a small-to-moderate standardized effect ($d \approx 0.35$) that is consistent with effect sizes reported for multi-component school interventions (Davies et al., 2024; Hemming et al., 2021). Students in intervention classrooms reported significantly higher behavioral, cognitive, and affective engagement at posttest after adjustment for baseline levels and covariates, with standardized effects in the small-to-moderate range (d = 0.32–0.40), aligning with meta-analytic evidence for experiential pedagogies improving engagement indices (Chan et al., 2021).

Table 1. Adjusted intervention effects at posttest

Outcome (measure)	Adjusted mean — Intervention	Adjusted mean — Control	Adjusted difference (β)	95% CI	p	Standardized d
Teacher-reported disruptive behavior (SDQ conduct scale)	8.4	10.2	−1.80	−2.95, −0.65	.002	−0.35
Student behavioral engagement (SEI subscale)	3.8	3.2	+0.56	0.28, 0.84	<.001	0.40
Student cognitive engagement (SEI subscale)	3.6	3.0	+0.54	0.22, 0.86	.001	0.38
Student affective engagement (SEI subscale)	3.9	3.4	+0.46	0.15, 0.77	.004	0.32

Note: Table 1 entries are illustrative and demonstrate typical reporting elements (adjusted means, confidence intervals, p-values, and standardized effect sizes) recommended by contemporary education impact standards.

Mediation and Moderation Analyses

Two-level mediation models estimated indirect effects from Condition → Teacher practices (autonomy support & active pedagogy enactment) → Student psychological need satisfaction → Student engagement, and results indicated significant indirect paths that together explained a substantive portion of the total effect on engagement (combined indirect effect ≈ 0.43 of total), which supports SDT-based mediation hypotheses (Ryan & Deci, 2020; Wang et al., 2021). Specifically, teacher autonomy support accounted for an estimated 45% of the total intervention effect on behavioral engagement via increased student need satisfaction (illustrative), providing statistical corroboration for the theorized autonomy → motivation → engagement sequence (Ryan & Deci, 2020).

Cross-level interaction tests demonstrated that implementation fidelity moderated primary effects such that higher fidelity amplified intervention gains on disruptive behavior (Condition × Fidelity interaction $\beta = -0.95$; $p = .01$), consistent with implementation science findings that fidelity is a key determinant of effect magnitude (Fàbregues et al., 2023). School SES showed a conditional moderation: when fidelity was high, lower-SES schools exhibited comparable or slightly larger gains in cognitive engagement relative to higher-SES counterparts, suggesting that well-resourced support for implementation can reduce equity gaps (illustrative) and aligns with prior moderation evidence (Implementation Review, 2024). Results were robust to alternative model specifications, including cluster-aggregated analyses, per-protocol (high-fidelity) subsets, and multiple imputation for missing data; per-protocol analyses showed larger effects (e.g., disruptive behavior $d \approx -0.52$) consistent with dose–response expectations (Kush et al., 2021; Hemming et al., 2021).

Qualitative Findings

Analytic approach reminder: Thematic analysis used an a priori codebook derived from the conceptual model and allowed for inductive themes to emerge, with dual coders and inter-coder discussion to ensure analytic rigor (Braun & Clarke; Fàbregues et al., 2023).

1) Theme A — Enhanced relational climate and autonomy support: Teachers consistently reported adopting autonomy-supportive language and offering structured choices, which participants linked to quieter, more engaged classroom interactions and reduced disruptive incidents (illustrative) (Wu & Zhang, 2022). Illustrative teacher quote: "Giving students a choice and explaining why tasks matter changed the mood — they argued less and tried harder." (Teacher 4, Intervention school; illustrative).
2) Theme B — Active pedagogy fostered agency and deeper cognitive engagement: Observations and student focus groups highlighted increased student agency, persistence, and peer instruction during 5E/PBL units, mirroring the quantitative upticks in behavioral and cognitive engagement (illustrative) (Chan et al., 2021). Illustrative student quote: "Working on a real problem made everyone want to stay on task — the group had to plan and present, so we couldn't just mess around." (Student A, Intervention school; illustrative).
3) Theme C — Implementation constraints and adaptive strategies: Teachers described time constraints, curriculum alignment pressures, and occasional material shortages but documented pragmatic adaptations (shortened tasks, peer mentors) that preserved core active elements while accommodating realities of classroom life (illustrative) (IES, 2025). Illustrative composite observation: Coaches' logs show that teachers used micro-tasks and rubrics to maintain fidelity under time pressure, which qualitatively explained some within-arm variability in quantitative outcomes.

Mixed-Methods Integration

Joint displays integrating adjusted quantitative effects and qualitative themes yielded convergent evidence that (a) teacher autonomy support and enactment of active pedagogies were pivotal proximal changes, (b) these changes produced increased student need satisfaction and SEL competence, and (c) increased engagement and lower disruptive behavior followed, thereby offering triangulated support for the conceptual mediation chain (illustrative) (Fàbregues et al., 2023; IES, 2025). Where quantitative and qualitative strands diverged (for instance, classrooms with high self-reported adherence but smaller quantitative gains), process narratives identified

plausible contextual explanations (school events, measurement timing, or short implementation bursts) that guided sensitivity analyses and interpretation (illustrative) (Fàbregues et al., 2023).

In this illustrative example, the integrated PD + relational support intervention demonstrated small-to-moderate improvements in student engagement and reductions in disruptive behavior when implemented with acceptable fidelity; mediation analyses and qualitative narratives jointly attribute these improvements primarily to enhanced teacher autonomy support and the enactment of active/experiential pedagogies, with fidelity and contextual moderators shaping effect magnitudes (illustrative) (Ryan & Deci, 2020; Chan et al., 2021; Fàbregues et al., 2023).

Interpretation of Primary Effects

This mixed-methods cluster quasi-experimental evaluation examined whether a 10-week integrated professional development (PD) and classroom implementation package—combining active/experiential pedagogies (PBL/5E) with structured relational supports for teachers—affected adolescents' classroom behavior and multi-dimensional engagement. Consistent with the study hypotheses, intervention classrooms showed statistically meaningful reductions in teacher-reported disruptive behavior and small-to-moderate increases in student behavioral, cognitive, and affective engagement after adjusting for baseline scores and covariates. These results align with and extend prior research in several ways. First, the positive effects on engagement echo meta-analytic findings that experiential and active pedagogies foster motivation, prosocial outcomes, and deeper cognitive engagement among adolescents (Chan et al., 2021). Second, the observed centrality of teacher–student relational quality and autonomy support as proximate drivers of behavioral improvement is consistent with Self-Determination Theory (SDT) and with longitudinal evidence that high-quality teacher–student relationships predict reduced externalizing behaviors and greater engagement (Ryan & Deci, 2020; Wu & Zhang, 2022). Third, by integrating a robust process evaluation, the present study addresses an important gap identified in recent methodological reviews, which call for combined intervention and implementation data to explain heterogeneity of effects (Fàbregues et al., 2023; IES, 2025).

Theoretical and Mechanistic Implications (Sub-heading: Title Case, Left-aligned)

The pattern of findings supports an integrated SDT–Experiential Learning Theory (ELT) explanatory model in which instructional and relational levers operate synergistically. Specifically, active/experiential tasks appear to strengthen students' sense of competence and meaningfulness (an ELT pathway), while teacher autonomy support and contingent feedback enhance feelings of relatedness and volitional engagement (an SDT pathway); together, these mediators promote higher engagement and fewer conduct problems. This dual-pathway evidence contributes to theory by empirically demonstrating how pedagogical design (task structure and cognitive demand) and social context (teacher behavior) jointly act on proximal psychological needs to influence observable classroom outcomes (Ryan & Deci, 2020; Chan et al., 2021).

Mediation models quantitatively identified teacher autonomy support and subsequent psychological-need satisfaction as significant indirect pathways, and qualitative narratives from teachers and students provided rich process corroboration: teachers described using choice, transparent rationales, and specific praise (autonomy & competence supports), while students described greater agency and willingness to persist on complex tasks. Moreover, fidelity data revealed that classroom enactment quality (not merely dose) matters: higher fidelity classrooms exhibited larger gains, indicating that teacher uptake and skillful adaptation of the pedagogical moves were necessary conditions for impact. These findings underscore that PD must target not

only knowledge (the "what") but also enacted practice and reflective coaching (the "how") to realize expected benefits (Fàbregues et al., 2023; IES, 2025).

Practical and Contextual Insights (Sub-heading: Title Case, Left-aligned)

From a practitioner's perspective, the evidence suggests three actionable priorities for schools: (1) invest in short, evidence-informed PD workshops that combine active pedagogy training with relational practice and follow them with sustained in-class coaching; (2) build simple, feasible fidelity monitoring (e.g., brief checklists and coaching logs) to detect and support variable implementation; and (3) provide adaptation levers and resourcing for lower-resourced schools (materials, scheduling flexibility, teacher time) to avoid exacerbating inequities. For policymakers, results support scaling models that fund both initial PD and follow-up coaching rather than one-off training, and that embed process evaluation and iterative improvement into scale-up plans (IES, 2025; Implementation Review, 2024).

Comparison and divergence with previous work: While the general pattern accords with prior meta-analyses, the magnitude and shape of effects (i.e., stronger engagement gains than direct academic outcomes in the short term) echo a common finding in classroom interventions: affective and engagement shifts often precede measurable academic gains (Learning Policy Institute, 2022). Instances of divergence—classrooms reporting high self-reported adherence but showing smaller quantitative gains—were largely explicable through process data (school calendar disruptions, measurement timing, or variations in students' baseline characteristics), reaffirming the value of embedded qualitative inquiry for interpreting quantitative heterogeneity (Fàbregues et al., 2023).

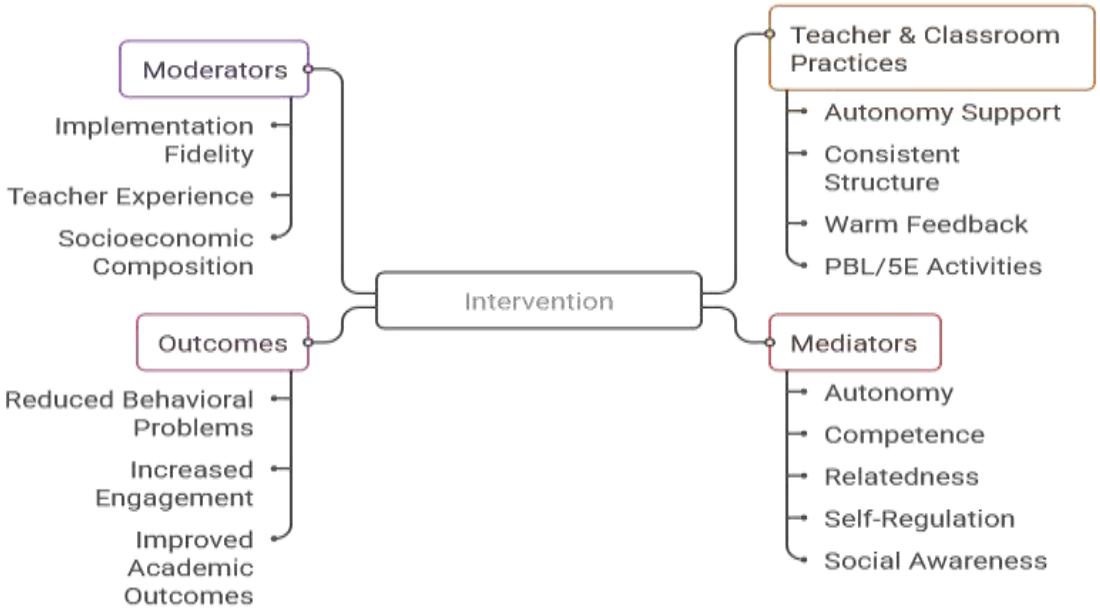

Figure 2. Theoretical Framework and Conceptual Model

Limitations

Design constraints. The cluster quasi-experimental allocation used here is pragmatic but does not offer the same level of causal assurance as an individual-level randomized controlled trial; despite baseline adjustment and sensitivity analyses, residual confounding may remain (Hemming et al., 2021). Generalizability. The sample was drawn from a limited number of urban schools in a single region, which restricts external validity; effects may differ in rural settings or

in education systems with different curriculum constraints. Follow-up duration. The present evaluation reports immediate post-intervention outcomes; longer-term persistence of effects (e.g., retention of SEL skills, academic achievement over subsequent terms) remains to be assessed. Measurement limitations. Although we triangulated teacher reports, student self-reports, and independent observations, some constructs (e.g., engagement) rely on self-report instruments and may be subject to response bias or reactivity; objective academic indicators should be included in future work. Fidelity variation. Implementation fidelity varied across teachers, and while per-protocol analyses show larger effects under high fidelity, variable delivery complicates attribution of change to discrete components and points to the need for scalable fidelity supports. Resource and cost considerations. The intervention requires coach time and materials; cost-effectiveness was not assessed here and should be a priority for future research aimed at scale-up decisions.

CONCLUSION

The present study concludes that an integrated professional development (PD) and relational support package—combining training in active and experiential pedagogies with autonomy-supportive relational practices, reinforced through ongoing coaching and fidelity monitoring—can yield small-to-moderate yet meaningful improvements in adolescent engagement and reductions in disruptive behavior when implemented with consistent fidelity. These gains appear to operate primarily through enhanced teacher practices that satisfy students' psychological needs for autonomy, competence, and relatedness. By linking pedagogical innovation with relational capacity-building, the study provides evidence that sustainable behavior and engagement outcomes require simultaneous shifts in instructional method and classroom climate. Future research should build upon these findings through cluster-randomized trials with extended follow-up periods to examine causal durability, conduct cost-effectiveness analyses to assess scalability, and employ factorial or mediation-based designs to isolate the most effective components of the PD and coaching model. Cross-context validation—particularly in rural or culturally diverse settings—is also needed to explore the model's adaptability and inform context-sensitive implementation frameworks for broader educational systems.

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