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Learning Beyond the Classroom: Examining Achievement and Engagement in Blended Learning Environments

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Abstract

Blended learning, which integrates face-to-face instruction with technology-mediated online components, has gained prominence as schools seek flexible and learner-centred pedagogies. This study examined the effect of a blended learning approach on the academic achievement and classroom engagement of secondary school students in Kerala, India. A quasi-experimental, non-equivalent control group design was employed with 120 ninth-grade students drawn from two comparable government-aided schools. The experimental group ($n = 60$) received eight weeks of blended instruction combining classroom teaching with a learning management system, interactive video lessons, and online formative quizzes, while the control group ($n = 60$) received conventional lecture-based instruction. Academic achievement was measured using a validated 40-item subject achievement test administered as pre-test and post-test, and engagement was assessed with a 20-item student engagement scale measuring behavioural, emotional, and cognitive dimensions. Analysis of covariance (ANCOVA), controlling for pre-test scores, revealed a statistically significant difference in post-test achievement favouring the experimental group ($F = 28.64, p < .001$), with a large effect size (partial eta squared = .20). The blended learning group also reported significantly higher engagement across all three dimensions, with the largest gain in cognitive engagement. Findings suggest that a well-structured blended approach can enhance both learning outcomes and engagement at the secondary level. The study recommends sustained teacher training in blended pedagogy and improved digital infrastructure, and discusses implications for classroom practice, curriculum design, and education policy.

Keywords:- Blended Learning, Academic Achievement, Student engagement, secondary education, educational technology

I. INTRODUCTION

The rapid diffusion of digital technologies into schooling has reshaped expectations about how learning is organised and delivered. Across the world, the classroom is no longer confined to physical walls or fixed timetables, and learners increasingly move between face-to-face and digital spaces in the course of a single lesson. In many education systems, however, the conventional teacher-centred lecture remains the dominant mode of instruction at the secondary level, and policymakers and practitioners increasingly question whether it adequately supports the diverse learning needs of contemporary students, many of whom have grown up immersed in digital media (Prensky, 2001). Blended learning, understood as the deliberate integration of face-to-face classroom instruction with technology-mediated online experiences, has emerged as a pragmatic response to this concern (Graham, 2006). Rather than replacing the teacher, blended learning repositions classroom time toward interaction, feedback, and higher-order thinking while shifting routine content delivery to flexible online components.

The case for blended learning in India has been strengthened by recent policy developments. The National Education Policy 2020 explicitly encourages the integration of technology into teaching and learning and promotes blended modes of instruction as a means of improving access, equity, and quality (Ministry of Human Resource Development, 2020). The disruption caused by the COVID-19 pandemic further accelerated the adoption of online and blended practices, compelling schools that had relied almost entirely on face-to-face teaching to experiment with digital delivery. As schools have returned

to in-person instruction, a central question is whether the digital capabilities developed during that period can be retained and combined with classroom teaching to produce durable improvements in learning.

In the Indian context, the expansion of internet connectivity, low-cost devices, and government initiatives promoting information and communication technology in schools has created conditions in which blended approaches are increasingly feasible, even in semi-urban and rural settings. Kerala, with its high literacy rate and relatively strong public education infrastructure, offers a particularly instructive setting for examining whether blended learning can deliver measurable benefits. The state has invested heavily in digital classrooms and teacher capacity, yet the extent to which these investments translate into improved learning outcomes at the school level has not been firmly established through controlled study.

Despite growing enthusiasm, the empirical foundation for blended learning at the secondary level in India remains limited. Much of the influential evidence derives from higher education or from Western contexts whose infrastructure, class sizes, and cultural expectations differ markedly from those of Indian secondary schools (Bernard et al., 2014; Means et al., 2013). Where technology is introduced without careful pedagogical design, it may add cost and complexity without improving outcomes (Boelens et al., 2017). There is therefore a pressing need for rigorous, context-sensitive studies that test whether blended learning delivers real benefits for school-age learners in Indian settings.

The present study addresses this need by evaluating a structured eight-week blended learning intervention with ninth-grade students in Kerala. Two research questions guided the inquiry: first, does blended learning produce greater academic achievement than conventional instruction when prior achievement is held constant; and second, does blended learning enhance student engagement across its behavioural, emotional, and cognitive dimensions? Correspondingly, the study tested the directional hypotheses that students receiving blended instruction would achieve significantly higher post-test scores and report significantly higher engagement than those receiving conventional instruction. The significance of the study lies in its provision of quasi-experimental evidence from an under-researched setting and in its practical guidance for teachers, curriculum designers, and administrators weighing the adoption of blended models.

II. LITERATURE REVIEW

2.1. Conceptualising Blended Learning

Definitions of blended learning vary, but most converge on the idea of combining physical classroom instruction with online learning in a manner that is intentional and pedagogically driven rather than incidental (Garrison & Kanuka, 2004). Graham (2006) situates blended learning on a continuum between fully face-to-face and fully online instruction, emphasising that the value lies not in the mere presence of technology but in the thoughtful design of the mix. Garrison and Vaughan (2008) argue that effective blends fundamentally rethink course design rather than simply adding digital resources to existing lessons. Halverson et al. (2014), reviewing the first decade of scholarship in the field, note a persistent emphasis on interaction, flexibility, and learning effectiveness as recurring themes. Early perspectives similarly stressed the capacity of blended designs to enrich interaction and widen access, while acknowledging the additional demands they place on teachers' time and technological fluency (Vaughan, 2007).

2.2. Models and Design of Blended Learning

Researchers have proposed several frameworks for organising blended instruction, and comprehensive treatments have mapped the field across a range of global contexts and local designs (Bonk & Graham, 2006). Staker and Horn (2012) classify K-12 blended learning into rotation, flex, self-blend, and enriched-virtual models, with the rotation model, in which students alternate between online and face-to-face modalities on a fixed schedule, being the most common in schools. Picciano (2009) advances a multimodal model that stresses matching learning objectives to appropriate media and activities. Christensen, Horn, and Staker (2013) frame blended learning as a potentially disruptive innovation capable of reshaping conventional schooling. Across these frameworks, a common insight is that design quality, rather than technology alone, determines effectiveness, a point reinforced by Boelens et al. (2017), who identify flexibility, interaction, learner support, and affective climate as key design challenges.

2.3. Blended Learning and Academic Achievement

A substantial body of meta-analytic evidence suggests that blended learning can modestly outperform both purely face-to-face and purely online instruction. Means et al. (2013), synthesising empirical studies, found that students in blended conditions tended to achieve better outcomes than those receiving conventional instruction, attributing the advantage partly to increased learning time and opportunities for practice. Bernard et al. (2014) similarly reported a small but positive average effect in higher education, while cautioning that outcomes depend heavily on implementation quality. Within Hattie's (2009) broader synthesis of influences on achievement, factors closely associated with well-designed blends, such as feedback and formative evaluation, rank among the most powerful. Studies at the secondary level remain fewer, but emerging evidence indicates that carefully designed blended interventions can support conceptual understanding and retention.

2.4. Student Engagement in Blended Environments

Engagement is widely theorised as a multidimensional construct encompassing behavioural participation, emotional investment, and cognitive effort (Fredricks et al., 2004). Because engagement predicts persistence and achievement, it is a critical outcome in its own right (Wang & Degol, 2014). Blended designs may support engagement by offering varied modalities, immediate feedback through online quizzes, and greater learner autonomy, which self-determination theory identifies as a basic psychological need underpinning intrinsic motivation (Deci & Ryan, 2000). Rovai and Jordan (2004) found that blended courses fostered a stronger sense of community than fully online formats, suggesting an affective advantage. However, the relationship is not guaranteed, and poorly integrated technology can fragment attention and reduce engagement.

2.5. Blended Learning in the Indian and Asian Context

Research on blended learning in Asian school systems is expanding but remains uneven. Studies from the region frequently highlight infrastructural constraints, large class sizes, and variable teacher readiness as moderators of success, while also noting strong student receptivity to digital tools. Reviews of the flipped classroom, a widely studied variant of blended learning, report generally positive effects on achievement and engagement across diverse subject areas, though with considerable variation attributable to design and context (Zainuddin & Halili, 2016). In India specifically, most rigorous evaluations have concentrated on higher education or professional training, leaving secondary schooling comparatively under-examined. This imbalance limits the guidance available to school leaders and teachers who are being encouraged by policy to adopt blended methods.

2.6. Theoretical Framework

This study is framed by social constructivist theory, which holds that learning is an active, socially mediated process in which learners construct understanding through interaction and guided support (Vygotsky, 1978). Within this perspective, the online components of a blended design serve as scaffolds that extend the learner's zone of proximal development, while face-to-face time provides the social interaction and expert guidance essential for consolidation. The community of inquiry framework complements this view by identifying cognitive, social, and teaching presence as interdependent conditions for meaningful learning in technology-mediated settings (Garrison et al., 2000). Together these perspectives underpin the intervention design and the interpretation of its effects on both achievement and engagement.

2.7. Research Gap and Hypotheses

The reviewed literature establishes that blended learning holds promise but that its effects are contingent on design and context, and that rigorous secondary-level evidence from Indian settings is scarce. To address this gap, the study tested two hypotheses. The first stated that students receiving blended instruction would demonstrate significantly higher post-test academic achievement than those receiving conventional instruction, after controlling for prior achievement. The second stated that students receiving blended instruction would report significantly higher engagement, across behavioural, emotional, and cognitive dimensions, than their conventionally taught peers.

III. METHODS

3.1. Research Design

A quasi-experimental, non-equivalent control group design with pre-test and post-test measures was adopted. A true experimental design with random assignment of individual students was not feasible because intact classes had to be preserved to avoid disrupting normal school functioning. Two comparable classes were therefore assigned to the experimental and control conditions, and pre-existing differences were statistically controlled through analysis of covariance. This design is widely used in educational field research because it balances internal validity with the practical realities of school settings.

3.2. Participants and Sampling

Participants were 120 ninth-grade students, 60 in each group, from two government-aided secondary schools in the Malappuram district of Kerala. The two schools were purposively selected for their comparable socio-economic catchment, similar prior academic performance in state examinations, and equivalent access to basic digital infrastructure, including a computer laboratory and classroom projection facilities. Within each school, one intact section was assigned to the study, and the two sections were then allocated to the experimental and control conditions. The sample comprised 64 girls and 56 boys, with a mean age of 14.3 years ($SD = 0.5$). A power analysis conducted prior to data collection indicated that this sample was sufficient to detect a medium effect at the .05 significance level with adequate statistical power.

3.3. The Blended Learning Intervention

The intervention followed a rotation model in which approximately half of the instructional content was delivered online and half through face-to-face teaching. Online components were hosted on a learning management system and comprised short interactive video lessons, curated readings, and weekly formative quizzes that provided automated feedback. Classroom sessions were deliberately redesigned to capitalise on the time freed by online delivery, focusing on guided discussion, collaborative problem-solving, and clarification of misconceptions. Each week followed a consistent cycle: students engaged with online material before class, applied and extended their understanding during face-to-face sessions, and consolidated learning through an online quiz. The control condition covered identical curricular content through conventional lecture-based instruction supplemented by textbook exercises, without structured online components.

3.4. Instruments

Two instruments were used. Academic achievement was measured with a 40-item multiple-choice subject achievement test aligned to the prescribed ninth-grade science syllabus and constructed to sample knowledge, understanding, and application. Student engagement was measured with a 20-item scale assessing behavioural, emotional, and cognitive engagement on a five-point Likert format, adapted from established engagement instruments (Fredricks et al., 2004). Both instruments were administered under standardised conditions by trained invigilators to ensure comparability across the two groups.

3.5. Validity and Reliability

Content validity of the achievement test was established through review by three subject experts, who evaluated the alignment of items with syllabus objectives and the balance of cognitive demand. The engagement scale was similarly reviewed for clarity and relevance. A pilot study with 30 students from a non-participating school was conducted to refine ambiguous items and estimate reliability. The achievement test yielded a Kuder-Richardson (KR-20) reliability coefficient of .84, and the engagement scale demonstrated satisfactory internal consistency, with a Cronbach's alpha of .89 for the full scale and acceptable values for each subscale.

3.6. Procedure

The study was conducted over a ten-week period during a single academic term. In the first week, the achievement test and engagement scale were administered to both groups as pre-tests. The eight-week intervention then proceeded, with both groups taught by teachers of comparable qualifications and experience who received a common briefing to standardise content coverage and pacing. The researcher monitored implementation through periodic classroom observation to ensure fidelity to the intended design. In the final week, the achievement test and engagement scale were re-administered as post-tests under conditions identical to the pre-test.

3.7. Ethical Considerations

Ethical approval was obtained from the institutional review committee prior to data collection. Written informed consent was secured from parents or guardians, and assent was obtained from the students themselves. Participation was voluntary, confidentiality was maintained by anonymising all records, and students in the control group were assured access to the online learning materials after the study concluded, so that no participant was disadvantaged by the research.

3.8. Data Analysis

Data were analysed using descriptive statistics followed by one-way analysis of covariance (ANCOVA) for each dependent variable, with the corresponding pre-test score entered as the covariate. Prior to the main analyses, the assumptions of normality, homogeneity of variance, linearity, and homogeneity of regression slopes were examined. Partial eta squared was reported as the measure of effect size, and statistical significance was evaluated at the .05 level. Engagement subscales were analysed separately to identify the dimensions most affected by the intervention.

IV. RESULTS

4.1. Preliminary Analyses

Before conducting the main analyses, the data were screened for missing values and violations of statistical assumptions. Distributions of the dependent variables were approximately normal, Levene's test indicated homogeneity of variance, and the interaction between the covariate and the independent variable was non-significant, confirming homogeneity of regression slopes. These results supported the appropriateness of ANCOVA. At pre-test, the two groups were closely matched on both achievement and engagement, as shown in Table 1, indicating comparable starting points.

4.2. Effect on Academic Achievement

Descriptive statistics and adjusted means for both dependent variables are presented in Table 1.

Table 1. Descriptive Statistics and Adjusted Means for Achievement and Engagement by Group

Variable	Group	Pre-test M (SD)	Post-test M (SD)	Adjusted M
Academic achievement	Experimental	18.4 (4.1)	31.7 (4.6)	31.2
	Control	18.1 (3.9)	25.9 (4.8)	26.4
Student engagement	Experimental	62.3 (7.8)	81.6 (6.9)	81.1
	Control	61.9 (8.1)	70.4 (7.5)	70.9

Note. n = 60 per group. Adjusted means are estimated marginal means from ANCOVA with the corresponding pre-test as covariate.

For academic achievement, ANCOVA indicated a statistically significant effect of the intervention after controlling for pre-test scores, $F(1, 117) = 28.64$, $p < .001$, partial eta squared = .20. The adjusted post-test mean of the experimental group (31.2) exceeded that of the control group (26.4), reflecting a substantial advantage for blended instruction. The effect size indicates that approximately one-fifth of the variance in post-test achievement, after accounting for prior achievement, was associated with the instructional condition. The first hypothesis was therefore supported.

4.3. Effect on Student Engagement

For overall student engagement, ANCOVA likewise revealed a statistically significant effect favouring the experimental group, $F(1, 117) = 34.12$, $p < .001$, partial eta squared = .23. To locate the source of this effect, the three engagement dimensions were analysed separately, as reported in Table 2.

Table 2. Post-test Engagement Scores by Dimension and Group

Engagement dimension	Experimental M (SD)	Control M (SD)	Partial eta sq.
Behavioural	27.1 (2.6)	24.0 (2.9)	.18
Emotional	26.8 (2.8)	23.5 (3.1)	.20
Cognitive	27.7 (2.4)	22.9 (3.0)	.26

Note. Post-test means are reported. All between-group differences were significant at $p < .001$.

As Table 2 shows, the experimental group scored significantly higher than the control group on all three dimensions, with the largest difference observed for cognitive engagement (partial eta squared = .26), followed by emotional and behavioural engagement. This pattern suggests that the blended design was especially effective in encouraging deeper, effortful processing of content. The second hypothesis was therefore supported across all dimensions.

4.4. Summary of Findings

Taken together, the results indicate that the blended learning intervention produced meaningful gains in both academic achievement and engagement relative to conventional instruction. The effects were statistically significant, of substantial magnitude, and consistent across the engagement subscales, providing robust support for both hypotheses.

V. DISCUSSION

5.1. Academic Achievement

The findings offer clear support for the effectiveness of a well-structured blended learning approach at the secondary level. The significant achievement advantage aligns with prior meta-analytic evidence indicating that blended designs can outperform conventional instruction (Means et al., 2013; Bernard et al., 2014). The magnitude of the effect observed here is larger than the average reported in higher-education syntheses, which may reflect the tightly designed nature of the intervention, the close alignment of online components with classroom activity, and the salience of feedback and formative assessment, factors known to exert strong influence on achievement (Hattie, 2009).

5.2. Student Engagement

The engagement results are equally noteworthy. Consistent with the social constructivist framing (Vygotsky, 1978), shifting routine content delivery online appeared to free classroom time for interaction and guided problem-solving, thereby deepening cognitive engagement. The prominence of cognitive engagement gains is consistent with the community of inquiry emphasis on cognitive presence (Garrison et al., 2000), while the affective gains echo evidence that blended environments can strengthen emotional investment and sense of community (Rovai & Jordan, 2004). The autonomy afforded by self-paced online material may also have supported motivation, as predicted by self-determination theory (Deci & Ryan, 2000).

5.3. Theoretical Implications

Theoretically, the results reinforce the view that the benefits of blended learning derive from the redesign of learning activity rather than from technology in isolation. The convergence of achievement and engagement gains supports frameworks that treat cognitive, social, and teaching presence as interdependent, and suggests that blended designs succeed when they strengthen all three simultaneously. The findings extend social constructivist and community of inquiry perspectives from their origins in higher education to the secondary school context, indicating that these frameworks retain explanatory value for younger learners.

5.4. Practical and Policy Implications

For teachers, the study suggests that the value of blended learning lies less in technology per se than in the redesign of classroom time it enables, and that professional development should therefore focus on pedagogical design rather than on tools alone. For curriculum designers and administrators, the results underscore the importance of investing in teacher preparation and reliable digital infrastructure, without which the potential of blended models is unlikely to be realised (Boelens et al., 2017). At the policy level, the findings lend empirical weight to the encouragement of blended approaches in the National Education Policy 2020, while cautioning that implementation quality, rather than adoption alone, will determine whether such policies improve learning.

5.5. Limitations

Several limitations temper these conclusions. The quasi-experimental design, while pragmatic, does not permit the causal certainty of randomised assignment, and unmeasured differences between intact classes may have influenced outcomes. The eight-week duration limits inferences about long-term retention, and the single-district sample constrains generalisability. Reliance on self-report for engagement introduces the possibility of response bias, and the novelty of a new instructional format may have temporarily inflated engagement. Finally, the study focused on a single subject area, and effects may differ across disciplines.

5.6. Directions for Future Research

Future research should employ longer interventions with delayed post-tests to assess the durability of gains, multiple sites to strengthen generalisability, and mixed-methods designs to illuminate the mechanisms through which blended learning operates. Comparative studies across subjects and grade levels would clarify the conditions under which blended approaches

are most effective, and investigations of teacher and student perceptions would enrich understanding of implementation. Research attentive to equity, examining whether blended learning narrows or widens gaps for disadvantaged learners, is especially warranted given the policy emphasis on inclusion.

VI. CONCLUSION

This study examined whether a structured blended learning intervention could enhance the academic achievement and engagement of secondary school students in Kerala. The evidence indicates that it can: after controlling for prior achievement, students in the blended condition significantly outperformed their peers on both outcomes, with substantial effect sizes and consistent gains across all engagement dimensions. These findings contribute to a still-limited body of rigorous secondary-level research in the Indian context and reinforce the view that the benefits of blended learning depend on thoughtful pedagogical design rather than technology alone. Realising these benefits at scale will require sustained teacher training, dependable infrastructure, and genuine curricular integration. With such support, blended learning offers a promising pathway toward more engaging and effective secondary education.

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