

Improving Student Engagement and Motivation in Grade V Science through the Use of a Blended Teaching Approach: A Study at Rinchen Kuenphen Primary School

Tashi Dorji

Rinchen Kuenphen Primary School, Ministry of Education and Skills Development

Abstract

This action research study aimed to enhance student engagement, motivation, and academic performance in Grade V Science through the implementation of a blended teaching approach at Rinchen Kuenphen Primary School, Thimphu. To conduct this study a mixed-method research design was used involving 32 students over an eight-week intervention period. Quantitative data were collected through pre-test and post-test assessments and a structured motivation survey, while qualitative data were gathered through classroom observation and the researcher's reflective diary.

The findings of this study revealed a significant improvement in students' academic performance, with mean scores increasing from 6.64 to 9.14. Students' motivation levels were also found to be very high, indicating increased interest, participation, and confidence in learning Science. The blended teaching approach, integrating digital tools with traditional instructional methods, contributed to a more engaging and student-centered learning environment.

The study recommends the integration of blended teaching strategies in primary classrooms to enhance effective teaching and learning practices.

Keywords: Blended Teaching, Student Engagement, Student Motivation, Primary Science Education, Action Research, Academic Achievement, Digital Learning Tools

1.0 Introduction

Many educational sources state the student engagement is key to learning and it is recognized as a critical factor influencing effective learning outcome. When the students are vigorously engaged in learning activities, students demonstrate higher motivation, better understanding, and enhanced academic performance. A study conducted by UNICEF (2021) on digital learning activities in Bhutan stated that approximately 92% of students expressed positive engagement when interactive digital learning tools were used in the classrooms, the study shows that technology-supported learning can significantly enhance students' participation. Additionally, a study conducted on blended learning among students found that more than 60% of students reported positive learning experiences and improved motivation when blended learning approaches were implemented (Dorji, 2020). The above studies support that blended teaching approach can play a critical role in improving student engagement and improved academic performance in Bhutanese classrooms.

The students learn better through engaging in activity and this is at the core of all science education principles. Students should be involved in experimentation, discussion and inquiry-based activities in order to learn science. It integrates methods such as videos, online resources, interactive quizzes, and multimedia presentations with traditional activities like discussions, experiments, and group work. However, this does not genuinely happen in the classrooms. There is a large amount of teacher-centered teaching style where students are not vigorously engaged in science learning. Study on Bhutanese classroom practices shows that lessons frequently rely on lecture and textbook-based instruction, with limited opportunities for discussion, inquiry, or hands-on learning (Dorji et al., 2020).

The best of the classroom and the best of the digital world – videos, simulations and more. Blended teaching is an instructional approach that combines face-to-face classroom teaching with digital or technology-based learning tools. Blended Learning solutions have consistently motivated, engaged and educated learners. The expected outcome is to enhance learners' engagement, participation, and motivation towards learning science through a blended learning approach, and finally to raise their achievement in science at all levels.

Through this study, the researcher intends to enhance students' engagement and motivation through a blended teaching approach in teaching science. Incorporate various methods such as videos, online resources, interactive quizzes, multimedia presentation, collaborative learning activities and other digital tools to develop students' interest and understanding of science concept.

The studies conducted by other authors on blended teaching primarily focus on higher and secondary schools. Nevertheless, limited research on use of blended teaching in primary science classrooms in Bhutan. This study contributes by examining how the blended teaching can improve students' engagement and motivation in Grade V science through the use of a blended teaching approach at Rinchen Kuenphen Primary School. Through this approach, it provides practical strategies that can help primary school teachers apply blended teaching to enhance learning science. This study was conducted to explore how a blended teaching approach can enhance student engagement and motivation in Grade V Science at Rinchen Kuenphen Primary School.

1.2 Aims and objectives the research

1.2.1 Aims

The main aims of this study were to investigate the impact of blended learning approach towards increasing learners' engagement and motivation towards Science Education in Grade V students of Rinchen Kuenphen Primary School. This study explored how the blending learning method of integrating technology with traditional instructional practices helped create engaging student centered learning environment which would promote active participation, engagement towards science education and build the interest of the students in science education.

1.2.2 General objective

To enhance student engagement and motivation for learning science in Grade V by implementing a blended teaching approach at Rinchen Kuenphen Primary School.

1.2.3 Specific objectives

1. To apply blended teaching strategies that combine digital tools with traditional classroom instruction.
2. To analyze the effectiveness of blended teaching strategies in enhancing students' engagement, participation, and motivation.

3. To identify the challenges and limitations associated with implementing blended teaching strategies in a primary school classroom context.

1.2 Reconnaissance

1.2.1 Situational analysis

Rinchen Kuenphen Primary School is located in the capital city of Bhutan. The teachers and students have adequate facilities in terms of internet access, electronic gadgets, and exposure to digital tools. All the classrooms are well equipped with smart TVs and smart boards accessible to reliable internet connectivity to support digital-based teaching and learning. Teachers have knowledge and skills in using the digital tools have exposure using the digital tools during the teaching and learning process.

Despite possessing all the required facilities in the school, science lessons are often conducted in teacher-centered approach. The teachers dominate teaching and learning process by explaining and demonstrating science activities and providing notes to students. This results in providing minimal opportunities for students to actively participate. Although some students actively participate, however, some remain disengaged during the teaching and learning process. The facilities available in the classrooms are not meaningfully utilized by the teachers to enhance teaching and learning practices.

The availability of required digital resources in the school offers a prospect to effectively incorporate the blended teaching approaches to enhance science teaching and learning process. Thus, this study intends to explore how the use of blended teaching approach can enhance students' engagement and motivation in grade V science lessons at Rinchen Kuenphen Primary School.

1.2.2 Problem Statement

The main aim of science education in Grade V at Rinchen Kuenphen Primary School is to enhance students better understanding of scientific concepts and motivation through use of various teaching strategies in the teaching and learning process. However, through researchers' observation through instructional leadership practices, it was observed that some science lessons are teacher-centered method where the teachers explain the scientific concepts and demonstrations while students passively engaged in the teaching and learning process. This limits students' engagement and motivation in learning science in the classroom. Although some students who are academically sound actively engage in learning science, yet some students show low engagement and motivation in teaching and learning process in the classroom.

Rinchen Kuenphen Primary School is situated in capital city where digital technology is easily accessible including internet connectivity, Smart TVs, interactive boards in all the classrooms. However, despite advantage of having the facilities, these are not fully used to facilitate interactive teaching learning process by the teachers. Some teachers use limited digital tools (such as PPT, videos) and verbal explanation to impart science lessons to students which limits effective engagement and motivation of students in learning science. Therefore, there is need to explore new teaching strategies that can ensure learning science more engaging and motivating for students.

Blended teaching approach is a teaching strategy which combines with face-to-face classroom instruction with the digital learning tools. The blended teaching approach is found to be effective to enhance students' participation and motivation in learning (Bond, 2020; Graham, 2021; Wang, 2022; Yu, 2023; De Bruijn-Smolters et al., 2024). Thus, this study aims to examine the impact of blended teaching approach in enhancing students' participation and motivation in learning science in Grade V at Rinchen Kuenphen Primary School.

1.2.3 Significance of the study

This study is significant because the study intends to explore innovative strategies that will enable improving students' engagement and motivation in learning science at Rinchen Kuenphen Primary School. With this initiative, teachers can make a difference in teaching and learning science. This will enable teachers to incorporate digital tools in the teaching and learning process enabling teachers to make their classroom teaching more engaging and interesting. The outcome of this study will also provide insights for teachers to effectively incorporate blended teaching approaches to make learning science more engaging and meaningful.

Additionally, this study will provide support for school management to encourage teachers to use blended teaching approach in classroom practices to improve students' motivation and engagement. This will also serve as evidence of how incorporating blended teaching approach can help in improving students' engagement and motivation in learning science. This may also help in integrating blended teaching approach in primary school to improve quality of teaching science.

1.3 Competence

1.3.1 Researchers' Competence

The researcher has experiences in both teaching and learning over past 20 years serving in various levels and context of schools across Bhutan. The primary area of researchers' expertise lies within primary to lower secondary years of schooling. The work experience involved incorporating various teaching strategies, understanding issues (social and behaviour) challenges that arises in the classrooms. The researcher holds the Bachelors of Education and Master's of Educational Leadership, which provided a knowledge and skills in effectively implementing curriculum, pedagogy, and managing the school. The researcher attended various professional developments on conducting Action Research and possess competency required for conducting the Action Research. Additionally, the researcher conducted conventional research as a part of M.Ed requirement and also action research at the school level in 2024. Currently, the researcher teaches Science in Grade V, allowing the researcher to observe and incorporate blended teaching approach to enhance students' engagement and motivation in learning science. The researcher will be able to study classroom practices and put in place the right interventions because of what they learned from teaching, being a leader, and going to professional development.

Researcher's extensive teaching, leadership experience, and ongoing professional development empower me to critically evaluate educational practices and execute effective classroom interventions.

1.3.2 Research participants' competence

The research participants consisting of 32 students from Rinchen Kuenphen Primary School will be involved in this study. All the participants have basic knowledge on learning science through various activities based on their individual's interest and competency. This will enable the researcher to explore the influences of incorporating several teaching strategies. Additionally, the students are exposed to digital learning tools and have basic ICT skills to use the digital tools in the teaching and learning process. They have access to electronic gadgets and internet facilities to actively engage in blended teaching and learning approach.

1.3.3 Critical friend's competence

The critical friend will be a senior teacher who has the knowledge on conducting action research will serve as critical friend. The critical friend is competent with adequate experiences in action research, curriculum implementation and teaching practices. The knowledge and expertise in implementing different

pedagogies and action research of the critical friend will enable them to provide appropriate feedbacks on the research process during the study. This will help the research process focused on the intended study.

2.0 Literature Review

2.1 Concept of student engagement and motivation in primary Science.

Blended Teaching approach is vital for students since it breaks down the traditional walls of teaching style. Now with the access to digital tools, teachers can tailor the learning style of each student. Blended teaching approach provides flexible time for students to personalized their learning at their own pace. Blended learning is the process of combining the best parts of traditional classroom learning with online learning and learning that uses technology. Recently researchers have been discussing a lot in the literature on blended learning strategies which combine traditional face-to-face teaching and learning with technology-supported activities outside the classroom in order to increase student engagement and achievement. Graham (2021) affirms that blended learning is a teaching method that utilizes technology so as to support students learning outside the classroom.

2.2 Theories of motivation (Self-Determination Theory, Expectancy-Value Theory, Flow Theory).

Students' engagement in learning science plays a crucial factor that impacts student's learning. When students are provided opportunity to participate and involve actively in the science learning activities using wide range of digital tools, they show increased motivation level, better understanding, and enhanced academic performance. Student engagement is the action of students engaging in their learning through the display of their behaviour, affect, and learning (Bedenlier et al., 2020). Yahiaoui et al. (2022) also agrees that students would have more fun in learning, and the interactive learning and multiple learning styles would all promote students' motivation in learning.

2.3 Blended learning models and approaches (rotation, flipped classroom, flex model).

Many studies highlight the effectiveness of blended teaching approach benefiting students positively in improving student's engagement and academic performance. Graham (2021) explains that blended learning integrates the strengths of both traditional classroom teaching and online learning environments, providing flexible and interactive learning experiences.

2.4 Evidence of blended learning's impact on engagement and motivation in science.

Additionally, Horn and Staker (2015) state that blended teaching and learning approach enables students to access digital resources while still benefiting from teacher guidance and classroom interaction. A study conducted by Bond (2020) and Wang (2022) also show that the integration of digital tools such as videos, simulations, and online quizzes can significantly increase students' behavioral, emotional, and cognitive engagement in learning. A recent study conducted by Yu (2023) supports the benefits of blended teaching approach. He emphasizes; that environments utilizing a blended teaching and learning approach foster collaborative learning and a more profound comprehension of subject matter. De Bruijn-Smolters et al. (2024) asserted that blended learning markedly enhances student engagement and participation through the integration of technology - assisted learning with classroom interaction.

2.5 Teacher and student perspectives on blended learning.

Similar studies were conducted in Bhutan which highlights the growing benefits of blended teaching approach. The studies support the advantages of this teaching method which supports that using this approach help students achieve higher academic performance and engagement level. Wangchuk, Kado, and Dem (2023) examined Bhutanese students' perceptions of using Google Classroom as a digital learning platform and found that students considered it a useful tool for supporting online and blended

learning environments. Similarly, Dorji and Dorji (2024) study finding showed that students who learned through blended learning achieved significantly higher scores compared to those taught through traditional methods, indicating that blended teaching can improve academic performance and engagement. A study conducted by Wangmo (2021) said that many students preferred a blended teaching approach to learning, where traditional classroom is supported by digital resources and online material. The study supported that students felt motivated and engaged when teachers use blended teaching approach during the teaching and learning approach.

2.6 Gaps in literature: focus on Grade V in Bhutan, lack of evidence on specific blended learning components.

Despite advantages indicated by many studies and digital facilities accessible where researcher intend to conduct study, teachers still rely on teacher-centered teaching approaches in teaching science in primary school. Teachers dominate classroom instruction where students are not fully engaged in learning. Additionally, studies were conducted in Bhutan focused on higher secondary schools and limited studies are conducted on blended teaching approach in teaching science in primary school.

Accordingly, this study aims to address this gap by how a blended teaching approach can enhance students and engagement and motivation in grade V science lessons at Rinchen Kuenphen Primary School. By incorporating digital tools and engaging students in learning activities, the research intends to find out the impacts of how the blended teaching approach can improve students' participation and learning outcomes at Rinchen Kuenphen Primary School.

3.0 Action research questions

3.1 Main research question

How can a blended teaching approach enhance student engagement and motivation in Grade V science lessons at Rinchen Kuenphen Primary School?

3.2 Sub research questions

- What is the current level of student engagement and motivation in science classes?
- How can digital tools and traditional classroom activities be effectively integrated within a mixed educational framework?
- What impact do blended teaching methods have on students' interest, participation, and motivation in science class?
- What problems come up while using blended teaching methods, and what can be done to make them less of a problem?

4.0 Methodology

4.1 Research Design

This study adopted a mixed-method action research design. Action research was selected because it allows practitioners to investigate and improve their own classroom practices through iterative cycles of planning, action, observation, and reflection (Kemmis & McTaggart, 1988). The mixed-method approach enabled the triangulation of quantitative and qualitative data, strengthening the validity and credibility of findings. Quantitative data were collected through pre-test and post-test scores and a structured Likert-scale motivation survey, enabling statistical comparison and measurement of learning gains. Qualitative data were gathered through classroom observation checklists and the researcher's reflective diary, providing contextual insight into the processes of engagement and motivation that numbers alone cannot capture.

4.2 Research Setting and Context

The study was conducted at Rinchen Kuenphen Primary School, located in Thimphu, the capital city of Bhutan. The school is well-equipped with digital infrastructure: all classrooms have Smart TVs, interactive boards, and reliable internet connectivity. Teachers have foundational ICT skills and have been exposed to digital tools during the COVID-19 period. Despite these facilities, classroom observation revealed that science lessons were frequently delivered through teacher-centred lecture methods, with limited utilisation of available technology. This incongruence between infrastructure and practice created an ideal context for a blended teaching intervention.

4.3 Participants

The study involved 32 Grade V students (16 male, 16 female, mean age = 10.7 years) from Class V at Rinchen Kuenphen Primary School. The researcher was the class science teacher, providing direct access for classroom-based action research. Grade V students at this developmental stage are sufficiently competent to engage with digital tools and interactive activities while still benefiting substantially from teacher-guided instruction. All 32 students participated in both the pre-test and post-test, and all 32 completed the post-intervention motivation survey, resulting in no missing data.

A senior teacher with expertise in action research served as the critical friend throughout the study, reviewing data collection instruments, observing lessons, and providing formative feedback on the research process.

4.4 Intervention Design

The blended teaching intervention was implemented over eight consecutive weeks during the first term of 2026. Each week targeted specific digital and traditional learning components, progressively building student familiarity with blended methods:

Week	Phase	Blended Teaching Activities	Digital Tools Used
1	Baseline & Introduction	Pre-test, observation checklist, motivation survey; introduce blended approach	Pre-test instrument, survey forms
2	Digital Engagement	Science concepts via short videos; Kahoot and Quizizz quizzes; Google Classroom introduction; guided discussion	Kahoot, Quizizz, Google Classroom, YouTube
3	Visual & Collaborative	Video demonstrations followed by pair and group discussions; peer explanation tasks	YouTube, Padlet, live worksheets
4	Simulation & Inquiry	Teacher uses simulations and simple experiments to explain abstract science concepts	PhET simulations, interactive diagrams
5	Digital Assessment	Students complete digital quizzes; collaborative worksheet activities; peer assessment	Quizizz, Google Forms, live worksheets

6	Student-Led Learning	Small-group tasks; student presentations using both digital and classroom resources	Google Slides, Padlet, Kahoot
7	Reinforcement	Review videos; competitive quizzes; practical tasks; consolidation activities	Kahoot, YouTube, revision worksheets
8	Post-Assessment	Post-test; final observation checklist; motivation survey; student feedback	Post-test instrument, survey forms

4.5 Data Collection Instruments

3.5.1 Pre-Test and Post-Test

A 10-mark science test focused on the Grade V topic of Circulation (Heart and Blood) served as both the pre-test and post-test. The identical instrument was used at both assessment points to enable direct comparison of scores. The test comprised three sections: Section A (five multiple choice questions, 5 marks), Section B (three short answer questions, 3 marks), and Section C (two application-based questions, 2 marks). Test content was aligned with the Ministry of Education and Skills Development (MOESD) Grade V science curriculum and reviewed by an experienced science teacher for content validity.

4.5.2 Student Motivation Survey

A 26-item structured Likert survey was administered after the intervention to measure student motivation across seven themes: Interest in Science Learning (7 items), Use of Digital Tools and Multimedia (4 items), Collaborative Learning (2 items), Classroom Participation and Engagement (4 items), Confidence in Science (2 items), Blended Teaching Approach (2 items), and Confidence and Effort (5 items). Each item used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The survey was adapted from validated motivation instruments and contextualized for Grade V students using simple, child-friendly language.

4.5.3 Classroom Observation Checklist

A structured observation checklist with 21 indicators across four domains (Behavioural Engagement, Emotional Engagement, Cognitive Engagement, and Use of Blended Tools) was completed during each lesson. The critical friend completed independent observations at least twice per week, providing an additional perspective beyond the teacher-researcher's self-observation.

4.5.4 Researcher's Reflective Diary

The researcher maintained a structured reflective diary throughout the 8-week intervention. Each entry was guided by five prompts: (1) description of the lesson, (2) student engagement observations, (3) effectiveness of the blended approach, (4) challenges encountered, and (5) planned adjustments. These entries provided rich qualitative data for thematic analysis.

4.6 Data Analysis

Quantitative analysis was conducted using IBM SPSS Statistics. For the pre-test and post-test data, descriptive statistics (mean, standard deviation, standard error, minimum, maximum) were computed for both assessment points and for learning gain scores. A Shapiro-Wilk test confirmed deviation from normality ($p < 0.05$); however, given the sample size of $n = 32$, the paired samples t-test remains robust

under the Central Limit Theorem. A paired samples t-test was used to determine whether the difference between pre-test and post-test means was statistically significant at the $\alpha = 0.05$ level. Cohen's d was computed as a measure of practical effect size.

For the motivation survey, descriptive statistics were computed for each of the 26 items and for each of the seven composite theme scores. Response frequency distributions (counts and percentages for each Likert point) were tabulated for all items. Cronbach's alpha was calculated to assess internal consistency reliability for the full scale and for each theme. An independent samples t-test was used to compare male and female students' overall motivation scores. Theme intercorrelations were examined using Pearson's r. Qualitative data from observation checklists and reflective diary entries were analysed using thematic analysis. Data were coded manually into four primary themes: student engagement, digital tool effectiveness, challenges, and teacher practice. Theme frequencies were tracked across the eight weeks to identify developmental patterns.

4.7 Validity and Reliability

Instrument validity was ensured through alignment with the MOESD curriculum and review by experienced colleagues. Data triangulation — combining test scores, survey responses, observation data, and diary entries — strengthened the overall credibility of findings. The critical friend's independent observations provided a check on researcher bias. Cronbach's alpha for the full survey was $\alpha = 0.92$, indicating excellent internal consistency.

4.8 Ethical Consideration

Written informed consent was obtained from parents and guardians of all student participants before data collection commenced. Participation was voluntary, and student anonymity is maintained in all reporting. Since the researcher served as both teacher and investigator, care was taken to minimize conflicts of interest through the use of standardized instruments and independent verification by the critical friend.

5. Findings

This section presents the results of the data analysis in three parts: (A) academic performance data from the pre-test and post-test, (B) student motivation survey results, and (C) qualitative findings from observation checklists and reflective diary entries.

5.1 Part A: Academic Performance — Pre-Test and Post-Test Results

5.1.1 Descriptive Statistics

Table 1 presents the descriptive statistics for both assessment points and for the learning gain score.

Table 1: Descriptive Statistics — Pre-Test, Post-Test, and Learning Gain (n = 32)

Variable	Mean	SD	SE	Min	Max	Mean %	N
Pre-Test Score	6.641	2.095	0.370	1.00	9.00	66.4%	32
Post-Test Score	9.141	0.994	0.176	7.00	10.00	91.4%	32
Learning Gain	+2.500	1.621	0.287	1.00	6.50	+25.0%	32

The results show a substantial improvement in mean scores from the pre-test ($M = 6.641$, $SD = 2.095$) to the post-test ($M = 9.141$, $SD = 0.994$). The mean learning gain of 2.5 marks represents a 25-percentage point improvement. Notably, the standard deviation decreased markedly (from 2.095 to 0.994), indicating not only that scores improved on average but that performance became considerably more consistent across the class. The minimum post-test score (7.00) exceeded the class mean at pre-test (6.641), demonstrating that even the lowest-performing students after the intervention outperformed the average student before it.

5.1.2 Performance Band Analysis

Table 2 categorizes students into four performance bands at both assessment points, revealing the qualitative shift in achievement following the intervention.

Table 2: Students by Performance Band — Pre-Test vs post-test

Band	Range	Pre n	Pre %	Post n	Post %	Change
● Low	0–3	2	6.2%	0	0.0%	↓ All moved up
● Average	4–6	11	34.4%	0	0.0%	↓ All progressed
● Good	7–8	13	40.6%	6	18.8%	↓ Most advanced
● Excellent	9–10	6	18.8%	26	81.2%	↑ +20 students

The band analysis reveals a dramatic redistribution of student performance. Before the intervention, only 6 students (18.8%) achieved Excellent scores (9–10), while 13 students (40.6%) were in the Low or Average bands. After the intervention, 26 students (81.2%) achieved Excellent scores — a fourfold increase — and no students remained in the Low or Average bands. This finding is not merely statistically significant; it represents a transformation of the achievement profile of the entire class.

5.1.3 Paired Samples t-Test

A paired samples t-test was conducted to determine whether the mean improvement from pre-test to post-test was statistically significant.

Table 3: Paired Samples t-Test Results

Pair	Mean Diff.	SD	SE	95% CI Lower	95% CI Upper	t	df	Sig.
Pre – Post	–2.500	1.621	0.287	–3.085	–1.915	–8.722	31	< 0.001

Statistical Decision:

The paired samples t-test produced $t(31) = 8.722$, $p < 0.001$. Since $p < 0.001$ is well below the significance threshold of $\alpha = 0.05$, the null hypothesis (H_0 : no significant difference between pre-test and post-test scores) is rejected. There is a statistically significant improvement in Grade V science scores following the blended teaching intervention.

5.1.5 Effect Size

Effect size analysis indicated a very large practical impact of the intervention (Cohen's $d = 1.54$), suggesting that the blended teaching approach had a substantial effect on students' learning outcomes.

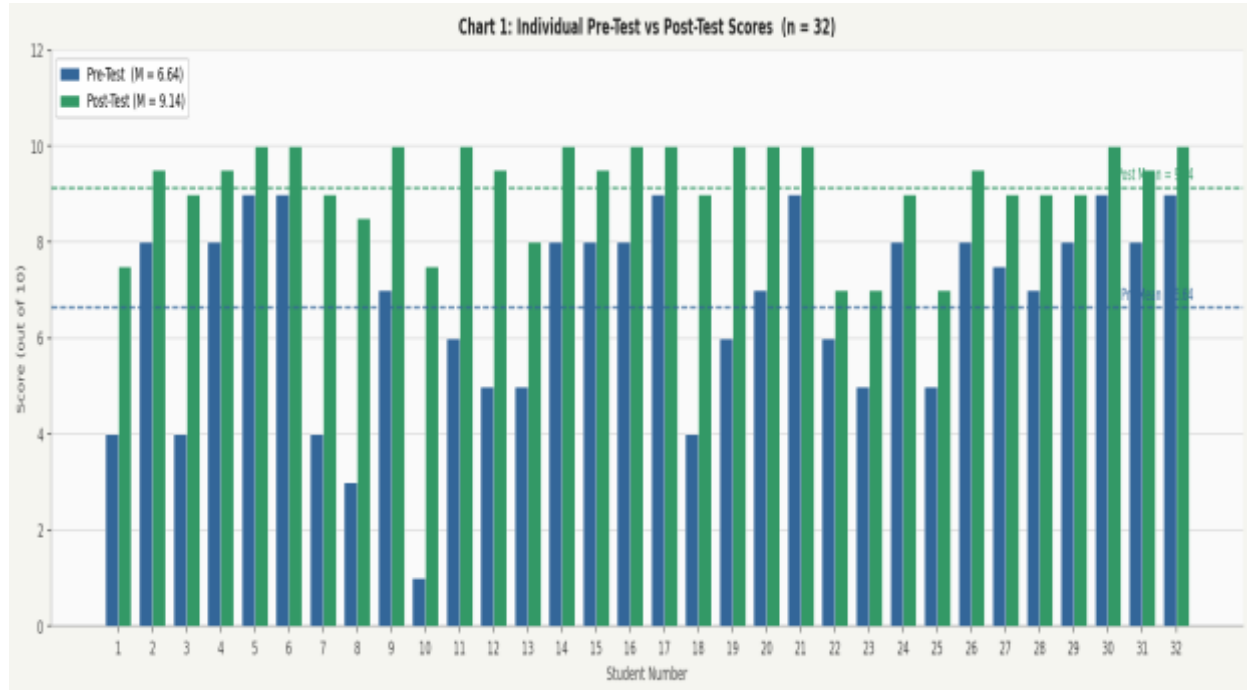


Figure 1. Individual pre-test (blue) and post-test (green) scores for all 32 students. Dashed lines indicate class means. Marked upward shift is evident across all students.

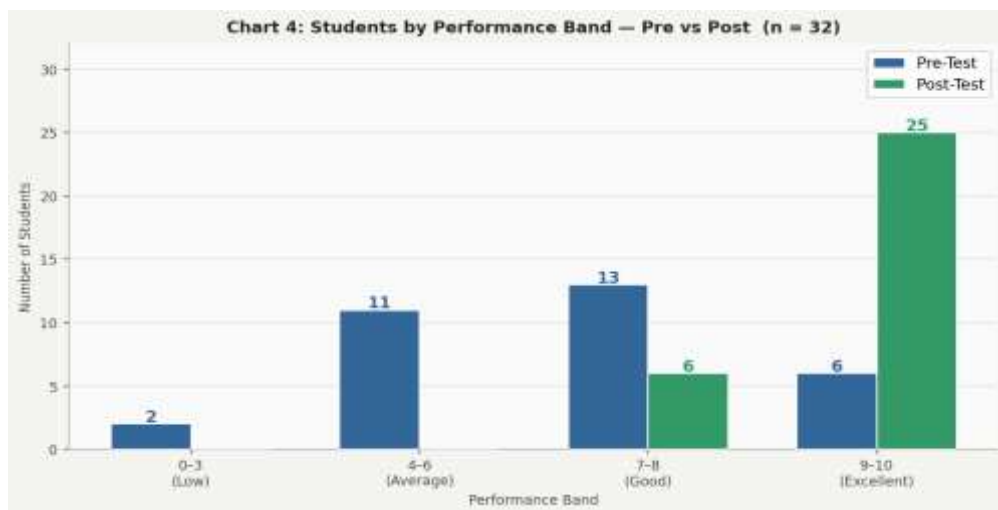


Figure 2. Performance band comparison. Excellent band grew from 6 students (18.8%) to 26 students (81.2%) after the intervention.

4.2 Part B: Student Motivation Survey Results

4.2.1 Overall Survey Results

The post-intervention motivation survey was completed by all 32 students. The overall mean score across all 26 items was $M = 4.639$ ($SD = 0.510$) on a 5-point Likert scale, indicating uniformly very high levels

of student motivation following the blended teaching intervention. Table 4 presents the descriptive statistics for each of the seven survey themes.

Table 4: Survey Theme Descriptive Statistics (n = 32)

#	Theme	Items	N	Mean	SD	Level
1	Interest in Science Learning	7	224	4.616	0.523	Very High
2	Digital Tools and Multimedia	4	128	4.695	0.511	Very High
3	Collaborative Learning	2	64	4.609	0.492	Very High
4	Participation and Engagement	4	128	4.531	0.560	Very High
5	Confidence in Science	2	64	4.688	0.467	Very High
6	Blended Teaching Approach ★	2	64	4.734	0.445	Very High ★
7	Confidence and Effort	5	160	4.669	0.485	Very High

All seven themes scored above 4.5/5.0. Theme 6 (Blended Teaching Approach) recorded the highest mean ($M = 4.734$), indicating that students strongly endorsed the blended approach over traditional teaching methods. Theme 4 (Participation and Engagement) recorded the lowest theme mean ($M = 4.531$), though this still represents a very high level of agreement. The narrow range between the highest and lowest theme scores ($4.734 - 4.531 = 0.203$) reflects remarkably consistent and positive motivation across all dimensions measured.

4.2.2 Individual Item Analysis

At the individual item level, all 26 items scored above the 4.0 "Agree" threshold. The highest-rated item was Q15 ("I pay more attention when multimedia is used", $M = 4.812$), while the lowest was Q19 ("I feel excited to participate in science activities", $M = 4.344$). Both represent strong positive responses.

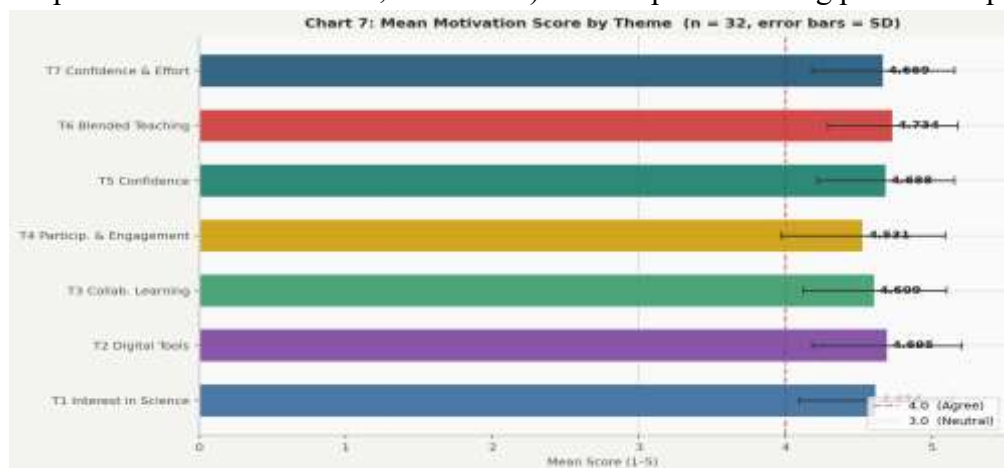


Figure 3. Theme mean scores with SD error bars. All seven themes clustered between 4.53 and 4.73, indicating uniformly high motivation across all dimensions.

4.2.3 Gender Comparison

An independent samples t-test was conducted to compare overall motivation survey scores between male (n = 16) and female (n = 16) students.

Table 5: Gender Comparison — Overall Motivation Survey Score

Group	n	Mean	SD	t	Sig.	Interpretation
Male	16	4.579	0.532	-3.423	0.001	Females higher*
Female	16	4.700	0.480			

Female students (M = 4.700) demonstrated significantly higher overall motivation scores than male students (M = 4.579), $t(30) = -3.423$, $p = 0.001$. This difference, while statistically significant, represents a relatively small practical gap (0.121 points on a 5-point scale). Across all seven themes, female students scored consistently higher than their male counterparts, as shown in Figure 4 below.

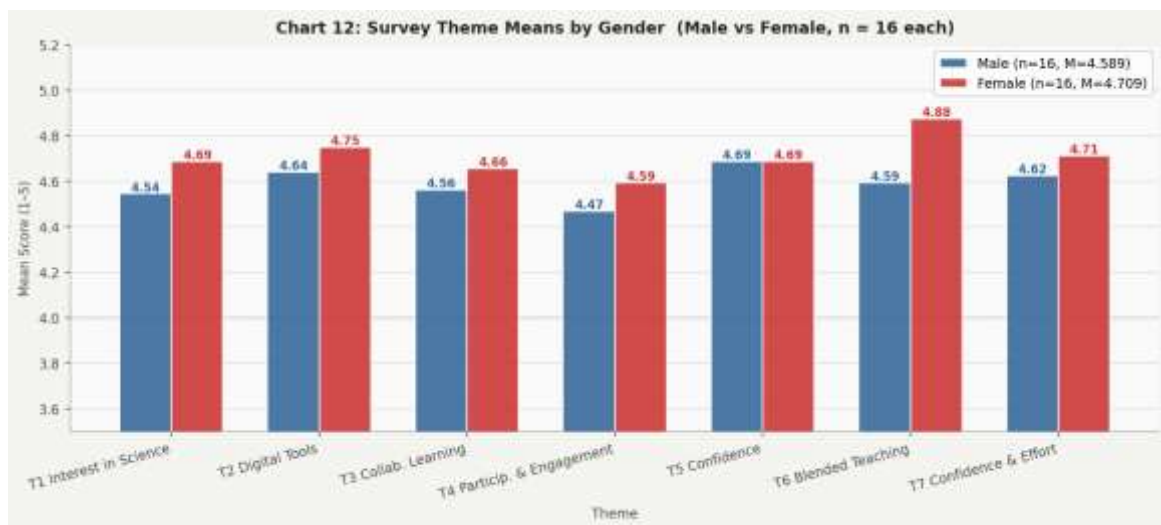


Figure 4. Theme mean scores by gender. Female students scored higher across all seven themes.

Independent t-test: $t(30) = -3.423$, $p = 0.001$.

4.3 Part C: Qualitative Findings

4.3.1 Classroom Observation

Systematic classroom observation across the 8-week intervention revealed a consistent and progressive improvement in all three dimensions of student engagement. In Week 1, observations noted that approximately 40% of students appeared disengaged during traditional instruction segments. By Week 4, following the introduction of Kahoot and Quizizz digital quizzes, on-task behaviour increased substantially, with fewer than five students exhibiting off-task behaviour in any given lesson.

Four primary themes emerged from observation data:

- **Behavioural engagement:** Students increasingly initiated unprompted participation — asking questions, volunteering answers, and persisting through challenging tasks. Kahoot quiz sessions produced the most consistently high engagement observed across all lessons.

- Emotional engagement: Students expressed visible excitement during digital activities, particularly during competitive quiz formats and simulation tasks. Group work generated positive peer interactions and increased willingness to take intellectual risks.
- Cognitive engagement: By Week 5, students were making connections between digital content and real-world applications unprompted. Application-based thinking became evident in class discussions and quiz responses.
- Digital tool transitions: Minor difficulties with time management during transitions between digital and traditional activities were observed in Weeks 2–3, but these resolved as routines were established. Technical issues (slow internet on two occasions) were managed through pre-downloaded content.

4.3.2 Reflective Diary Themes

Thematic analysis of the researcher's reflective diary entries yielded four recurring themes:

- Student transformation: Diary entries repeatedly noted students who had been quiet or disengaged in traditional lessons becoming active participants during blended activities. One entry observed: "Students who rarely spoke during teacher-led lessons were the most enthusiastic Kahoot players and were explaining concepts to their peers afterwards."
- Pedagogical confidence: The researcher noted growing confidence in integrating digital and traditional methods, with later entries reflecting more sophisticated lesson design choices and reduced reliance on the pre-planned sequence.
- Differentiation: Blended activities naturally accommodated diverse learning needs — visual learners engaged with video content, kinesthetic learners with simulations, and competitive learners with quiz formats.
- Challenges: Time management, ensuring equitable device access, and maintaining discipline during high-engagement digital activities were identified as recurring challenges requiring ongoing management.

5. Discussion

5.1 Academic Performance

The improvement in mean science scores from 6.641 (66.4%) at pre-test to 9.141 (91.4%) at post-test, with $t(31) = 8.722$, $p < 0.001$ and Cohen's $d = 1.542$, provides compelling evidence that the blended teaching intervention had a profound positive impact on student learning. This finding aligns with and substantially extends the Bhutanese evidence base. Dorji and Dorji (2024) found significantly higher scores in blended learning groups compared to traditional groups in Bhutanese secondary schools; the present study now provides comparable evidence at the primary level.

The magnitude of the effect size ($d = 1.542$) warrants particular attention. In educational research, where effect sizes above 0.4 are considered practically significant (Hattie, 2009) and above 0.8 are classified as large, a d of 1.542 is exceptional. It suggests that the blended approach did not merely add incremental value to existing practice, but fundamentally transformed the quality and depth of student learning. The convergence of multiple factors — increased engagement, more varied learning modalities, immediate feedback from digital quizzes, and collaborative reinforcement — likely combined synergistically to produce this outcome.

The reduction in score variability (SD decreased from 2.095 to 0.994) is equally significant from an equity perspective. It suggests that the blended approach benefited not only high-performing students but lifted all students, including those who had previously struggled. The finding that all students scored 7.0 or

above at post-test, with zero students remaining in the Low or Average bands, is particularly noteworthy in the Bhutanese context, where concerns about equitable learning outcomes are prominent.

5.2 Student Motivation

The post-intervention motivation survey results confirm that high academic performance was accompanied by equally high levels of student motivation. An overall mean of $M = 4.639/5.0$ across all 26 items, with all seven themes scoring above 4.5, indicates that the blended approach successfully created a learning environment in which students felt interested, confident, engaged, and motivated.

The highest-scoring theme was Theme 6: Blended Teaching Approach ($M = 4.734$), with 75.0% of students strongly agreeing that they preferred blended teaching over traditional methods. This finding directly addresses the study's main research question: students themselves recognized and valued the blended approach, reinforcing the objective academic gains with positive subjective experience. This alignment between performance outcomes and learner preferences is significant, as it suggests that the improvement is likely sustainable — students who enjoy and value their learning are more likely to continue engaging with it.

The highest individual item, Q15 ("I pay more attention when multimedia is used", $M = 4.812$), with 81.2% of students strongly agreeing, underscores the central role of multimedia in capturing and sustaining student attention. This resonates with cognitive load theory (Sweller, 1988), which suggests that well-designed multimedia can reduce extraneous cognitive load and enhance germane processing, supporting deeper learning. The finding is also consistent with the UNICEF (2021) report that 92% of Bhutanese students showed positive engagement when interactive digital tools were used.

The slightly lower score for Theme 4: Participation and Engagement ($M = 4.531$), while still very high, warrants reflection. Specifically, Q19 ("I feel excited to participate in science activities", $M = 4.344$) was the lowest individual item. This may reflect a distinction between general motivation to learn science and active enthusiasm for participation, particularly for shyer or less confident students. Targeted strategies to build participation confidence — such as low-stakes entry tasks, structured think-pair-share protocols, and incremental scaffolding of public participation — could address this in future cycles.

5.3 Gender Differences

The finding that female students demonstrated significantly higher overall motivation ($M = 4.700$) than male students ($M = 4.579$, $p = 0.001$) is of particular interest given the Bhutanese context, where gender equity in STEM education has been a national policy priority. This finding suggests that the blended teaching approach may be particularly effective in engaging female students in science learning — a result with implications for equity-focused educational planning.

However, it is important to note that both groups demonstrated very high motivation, with male students' mean score of 4.579 also well above the "Agree" threshold. The practical significance of the gender gap (0.121 points on a 5-point scale) is modest despite its statistical significance at $p = 0.001$ (which partly reflects the sensitivity of the independent t-test with equal-sized groups). Future research with larger samples would be needed to characterise this difference more precisely.

5.4 Qualitative Evidence

The qualitative data from observation checklists and reflective diary entries provide crucial contextual depth to the quantitative findings. The progressive increase in all three dimensions of engagement — behavioural, emotional, and cognitive — observed across the eight weeks suggests a developmental trajectory: students did not simply respond positively to novel stimuli but developed genuine habits of engagement that deepened over time. This is consistent with flow theory (Csikszentmihalyi, 1990), which

predicts that engagement deepens as students' skills and the challenges presented by tasks become better matched.

The observation that students who had been disengaged in traditional lessons became active participants during blended activities is particularly compelling. It suggests that the blended approach was not merely more appealing to already-engaged students, but genuinely reached students who had previously been excluded from meaningful participation — a finding with significant implications for inclusive education.

5.5 Limitations of the Study

This study may have several limitations. First, the research is conducted with a limited number of participants from a single class, which may limit the generalizability of the findings. Second, the duration of the intervention may be relatively short to observe long-term effects of blended teaching strategies. Third, access to digital resources and technology may influence the effectiveness of the intervention. Additionally, the researcher's dual role as both teacher and researcher may introduce potential bias during data collection and interpretation. However, reflective practices and the involvement of a critical friend will help minimize such limitations.

6. Recommendations

Based on the findings of this study, the following evidence-based recommendations are made for teachers, school management, and policy stakeholders at both the school and national levels.

6.1 For Classroom Teachers

1. Integrate blended teaching systematically into primary science lessons by integrating digital tools such as videos, quizzes, and simulations with traditional teaching methods to enhance student engagement.
2. Use high-engagement digital tools like Kahoot, Quizizz, and multimedia resources to promote active participation and immediate feedback.
3. Support less confident learners by using structured participation strategies such as pair work, group discussion, and low-risk digital activities.

6.2 For School Management

1. Provide continuous professional development to help teachers effectively implement blended teaching strategies in the classroom during the teaching and learning process.
2. Develop a school-level digital integration policy to ensure consistent and effective use of technology in classrooms.
3. Support action research as a continuous improvement mechanism to enable teachers to investigate and improve their own practices.

6.3 For Policy Makers (MoESD)

1. Promote blended teaching nationally by supporting training, research, and equitable access to digital infrastructure across schools.
2. Promote blended teaching nationally by supporting training, research, and equitable access to digital infrastructure across schools.

Conclusion

This action research study examined the impact of a blended teaching approach on student engagement, motivation, and academic performance in Grade V Science at Rinchen Kuenphen Primary School. The results of the study evidently indicate that the integration of digital tools during the teaching and learning process significantly improved student's learning. It was found that students demonstrated increased

participation, motivation, confidence in learning science which contributed to improved academic performance.

The findings of this study show that blended teaching approach creates interactive and learner-centered learning environment in the class, allowing students to engage actively in the learning process. The use of digital tools like videos, simulations, Kahoot, live work sheet, quizzie and collaborative activities supported and encouraged better understanding of scientific concepts. The improvement observed in students' performance suggest that the blended teaching approach was effective to students, including those students who were less engaged.

In conclusion, blended teaching is an effective and practical strategy for improving student engagement and learning outcomes in primary science classrooms. It is recommended that teachers adopt blended teaching approaches more systematically and make effective use of available digital resources. School management and relevant stakeholders should also support teachers through professional development and policy guidance to ensure successful implementation of blended learning practices.

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