IMPACT OF TEACHING MODEL-BASED INTERVENTIONS ON ACADEMIC ACHIEVEMENT AMONG HIGHER SECONDARY STUDENTS OF HINDI SUBJECT

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Abstract
Effective teaching methods significantly influence students' academic achievement, particularly in language subjects like Hindi at the senior secondary level. Traditional instructional approaches often fail to engage students, necessitating the adoption of structured teaching models to enhance learning outcomes. This study employed a quasi-experimental, cross-sectional design with a quantitative approach, selecting 600 students from 10 rural and urban higher secondary schools in Sarojini Nagar, Lucknow, through quota sampling. Data were collected via a structured questionnaire and analyzed using SPSS and MS Excel 16, incorporating reliability analysis, frequency analysis and paired t-tests. Findings indicated substantial academic improvement in the experimental group, with statistically significant t-values and p-values below 0.05, whereas the control group showed no notable changes. The study highlights the effectiveness of teaching models in enhancing Hindi learning and recommends their integration into instructional strategies for better academic outcomes.

Keywords: Education, Academic Achievement, Knowledge, Study, Motivation, Teacher-Student Interaction

1. Background

Academic achievement is a critical indicator of students' educational progress, often influenced by various instructional strategies. It encompasses cognitive, emotional, and behavioral aspects of learning, reflecting the effectiveness of teaching methodologies (Schunk & DiBenedetto, 2021). Teaching models play a crucial role in shaping student learning experiences, enhancing comprehension, retention, and application of knowledge (Joyce et al., 2018). Traditional and innovative teaching models significantly impact student performance. Conventional methods, such as lecture-based teaching, often lead to passive learning and reduced engagement (Kapur, 2019). In contrast, constructivist approaches, including inquiry-based, cooperative, and problem-solving models, enhance student interaction and critical thinking (Hmelo-Silver et al., 2019). Studies indicate that interactive teaching strategies improve subject comprehension and academic performance (Slavin, 2020).

Language learning, particularly Hindi at the senior secondary level, presents unique challenges requiring tailored instructional methods. Effective pedagogy, integrating teaching models such as direct instruction, peer tutoring, and multimedia-assisted learning, has been linked to improved literacy and comprehension (Krashen, 2020; Mayer, 2021). Teaching models incorporating digital tools have demonstrated positive effects on language acquisition (Graham et al., 2018). Research highlights the impact of teaching models on students' academic achievement. Active learning models enhance cognitive engagement and retention (Freeman et al., 2014). Comparative studies on experimental and control groups show that students exposed to structured teaching models outperform peers in traditional settings (Prince, 2019). Similarly, inquiry-based approaches have proven effective in fostering deeper understanding and application of knowledge (Hmelo-Silver, 2019).

Socioeconomic and psychological factors also influence academic achievement. Studies suggest that parental education, learning environment, and self-efficacy contribute significantly to student success (Bandura, 1997; Eccles & Wigfield, 2020). Teaching models addressing diverse learning needs, including differentiated instruction and scaffolding, enhance academic outcomes (Tomlinson, 2017). Despite extensive research on teaching methodologies, limited studies have examined their impact on Hindi language instruction at the senior secondary level. Existing literature lacks empirical

evidence comparing academic achievement in experimental and control groups using structured teaching models. This study aims to bridge this gap by assessing the effectiveness of teaching models in enhancing Hindi language learning outcomes.

1.1 Research Objectives-
1. To compare the level of academic achievement and its dimensions in pre and post intervention time in the control group of the student population in the study area.
2. To compare the level of academic achievement and its dimensions in pre and post intervention time in the experimental group of the student population in the study area.

1.2 Significance of the study
This study examines the impact of structured teaching models on the academic achievement of senior secondary Hindi students. By comparing pre- and post-intervention performance in control and experimental groups, it identifies effective instructional strategies. The findings aid educators in enhancing student learning, inform curriculum development, and support teacher training programs. Additionally, the study offers insights for policymakers to refine teaching frameworks, ultimately improving language education and academic outcomes.

2 Literature Review
Effective teaching requires flexibility, energy, and commitment, utilizing diverse strategies to meet varied learning needs (Kamboj & Singh, 2015). Approaches such as cooperative learning, case-based teaching, and digital tools enhance student engagement and academic performance. In rural India, digital video-based lessons significantly improved English and math scores, promoting student-centered learning (Sahni et al., 2008).

Language teaching strategies also influence proficiency, with heritage and foreign language learners exhibiting distinct linguistic patterns (Ilieva, 2012). Additionally, teacher gender impacts learning outcomes, as female teachers positively affect language acquisition but show no significant effect on mathematics achievement (Chudgar & Sankar, 2008). Socioeconomic factors play a crucial role in academic performance; however, their influence diminishes in residential education settings (Devi et al., 2022). Instructional practices further shape student success. In multilingual science classrooms, English remains the dominant instructional language due to socio-political factors, necessitating professional development for effective multilingual teaching (Bansal, 2022). In higher education, instant response systems benefit middle achievers, though satisfaction does not always correlate with performance (Koh & Kim, 2024). Maternal education strongly predicts student success, whereas family income exhibits a negative correlation with academic achievement (Udayakumar et al., 2022).

Motivation and personality traits significantly impact learning engagement, improving recall and persistence (Dhankhar & Alloni, 2019). Data-driven approaches enhance academic performance predictions, with Naïve Bayes achieving 91% accuracy in identifying at-risk engineering students (Verma et al., 2022). The persistence of colonial legacies in Indian schools continues to shape learning environments, while social-emotional learning interventions improve teacher-student relationships (Raju, 2024).

Game-based learning (GBL) is an effective pedagogical tool across disciplines, increasing academic achievement and engagement (Karakoç et al., 2022). Similarly, machine learning aids in predicting student performance, facilitating educational planning (Hussain & Khan, 2023). During COVID-19, emergency remote teaching yielded positive academic outcomes due to strong organizational strategies (Iglesias-Pradas et al., 2021). In Ethiopia, academic performance correlated with age, field of study, and smoking habits, emphasizing health as a critical factor in education (Tadese et al., 2022). Student motivation is a key determinant of academic success. Agustina et al. (2021) found a strong positive correlation between tertiary students' motivation and GPA. Game-based learning further supports motivation and retention, as evidenced by a quasi-experimental study in Arabic grammar where Kahoot!-based instruction improved student outcomes (Eltahir et al., 2021).

Conversely, academic and familial stress negatively impact learning, with stress leading to depression and subsequently lower academic performance (Deng et al., 2022). Mathematics anxiety similarly hinders achievement, though peer-based social regulation has been shown to improve both motivation and performance (Hwang et al., 2021). Online learning has transformed educational engagement. Polhun et al. (2021) validated Moodle-based electronic testing, while Clark et al. (2021) found that students receiving high-quality online instruction scored 0.22 SD higher, with computer users outperforming smartphone users. However, Panagouli et al. (2021) reported mixed effects, as younger and special-needs

students experienced learning losses during remote education. Digital competence plays a crucial role in academic success. Panagouli et al. (2021) identified digital informal learning as a key mediator between competence and performance. A study of 1,323 French university students revealed that innovative ICT usage enhanced academic outcomes, while inadequate ICT training had a negligible effect (Ben Youssef et al., 2022). Social-emotional learning (SEL) fosters academic success by enhancing emotional regulation, goal setting, and decision-making (Mahoney et al., 2021). Furthermore, learning styles influence achievement, with a significant correlation (r = 0.697) between preferred learning styles (visual, auditory, kinesthetic) and GPA/EPT scores (Ariastuti & Wahyudin, 2022).

Data-driven interventions further support student success. Zeineddine et al. (2021) proposed an automated machine-learning approach for early intervention, while self-regulated learning programs effectively boost academic performance through metacognitive strategies (Theobald, 2021). Blended learning models, particularly the flex model, significantly enhance math achievement and self-study skills, though findings remain constrained by sample size and duration (Tong et al., 2022). School climate also affects self-efficacy, with positive interpersonal relationships fostering higher performance in mathematics and English (Zysberg & Schwabsky, 2020). Additionally, personal values shape learning approaches, as alignment between values and academic skills contributes to holistic student development (Gamage et al., 2021).

Academic self-concept (ASC) and achievement share a reciprocal relationship, yet its developmental trajectory remains underexplored. A meta-analysis of 68 longitudinal studies confirmed this bidirectional link ($\beta = 0.16$, $p < 0.01$; $\beta = 0.08$, $p < 0.01$), with age moderating the effects (Wu et al., 2021). COVID-19 school closures had significant negative effects, particularly on younger and socioeconomically disadvantaged students, prompting discussions on mitigation strategies (Hammerstein et al., 2021). Achievement emotions further influence academic performance. Enjoyment is positively correlated with achievement ($\rho = .27$), whereas anger ($\rho = -.35$) and boredom ($\rho = -.25$) have negative associations, with stronger effects observed in secondary students (Camacho-Morles et al., 2021). Meanwhile, the shift to online learning during COVID-19 did not significantly affect student grades in an Egyptian university, suggesting the long-term viability of digital education (El Said, 2021).

2.1 Research Gap
Existing studies highlight various teaching strategies' impact on academic achievement (Kamboj & Singh, 2015; Sahni et al., 2008), but research on structured teaching models in Hindi at the senior secondary level remains limited. While factors like teacher gender, socio-economic status, and digital interventions have been explored (Chudgar & Sankar, 2008; Devi et al., 2022), their specific influence on Hindi learning is unclear. This study fills the gap by employing a quasi-experimental, cross-sectional design to assess teaching models' effectiveness in Hindi instruction.

3 Research Methodology
The study employed a quasi-experimental and cross-sectional design with a quantitative approach to investigate the impact of teaching through teaching models on academic achievement of students studying Hindi at senior secondary level. Utilizing a quota sampling technique, the research encompassed a sample size of 600 respondents specifically studying Hindi in class 11th & 12th in selected 10 higher secondary schools, drawn from rural and urban areas of Sarojni Nagar, Lucknow. Data were collected through a self-constructed structured questionnaire featuring close-ended questions, dichotomous items, multiple-choice questions, and Likert scales, administered in offline mode through scheduled appointments and paper-based distribution in selected schools. The pre-intervention data from both control group and experimental group were collected in the months of August & September, 2024. In the month of October 2024, a teaching model-based intervention program was administered to the experimental group for one month and then post intervention data were collected from both control group and experimental group in the months of November & December, 2024.

The primary data collected were analyzed using statistical tools including reliability analysis, frequency analysis and paired t test, performed with SPSS and MS Excel 16. The study also adhered to ethical considerations by obtaining informed consent, ensuring confidentiality and anonymity, and guaranteeing voluntary participation. To determine the levels of dimensions, scores for each were aggregated, and the range, minimum, and maximum values were computed. Class intervals were established by dividing the range by five, and each level was categorized from VLL (VLL) to VHL (VHL). This structured approach ensured a comprehensive analysis of the level of academic achievement and its dimensions (Cognitive Understanding and Perception, Study Habits and Educational Effort, Knowledge Application - Grammar and Writing Skills, Self-confidence and Motivation, Teacher-Student Interaction, Social and Peer Influence, Time Management and Organizational Skills) among the student population in the study area.

4   Results and Discussion
4.1 Demographic Profile of respondents

Table 1- Demographic Profile of respondents

Demographic Variable	Subcategory	Control Group	Experimental Group	Total
Name of School	New Public Collegiate Inter College	30	30	60
	St. Meera Public Inter College, Lucknow	30	30	60
	St. Thomas College	30	30	60
	Creative Convent College Lucknow	30	30	60
	Sky Public School	30	30	60
	Universal City Convent	30	30	60
	Lala Ram Swaroop Inter College Banthara Lucknow	30	30	60
	Rajkiya Uttar Pradesh Sainik Inter College Lucknow	30	30	60
	J.P. Public Inter College)	30	30	60
	Lucknow Public Academy Inter College)	30	30	60
Total		300	300	600
Type of School	Private College	150	150	300
	Government College	150	150	300
Total		300	300	600
Area of Residence	Urban Area	150	150	300
	Rural Area	150	150	300
Total		300	300	600
Gender	Male	163	163	326
	Female	137	137	274
Total		300	300	600
Age	15 to 16 Years	137	145	282
	17 to 18 Years	163	155	318
Total		300	300	600
Type of Family	Nuclear Family	162	166	328
	Joint Family	138	134	272
Total		300	300	600
Class	XI Class	139	112	251
	XII Class	161	188	349
Total		300	300	600
Faculty	Arts	158	154	312
	Commerce	86	88	174
	Science	56	58	114
Total		300	300	600

4.2 Reliability Analysis of Data

Table 2: Reliability of Data

Scale	Cronbach's Alpha	Number of Items
Academic Achievement in Control group (Pre)	.729	51

Academic Achievement in Control group (Post)	.741	51
Academic Achievement in Experimental group (Pre)	730	51
Academic Achievement in Experimental group (Post)	.801	51

All the scales showed high reliability of the data

4.3 Paired t test: Difference in Cognitive Understanding and Perception, Study Habits and Educational Effort, Knowledge Application - Grammar and Writing Skills, Self-confidence and Motivation, Teacher-Student Interaction, Social and Peer Influence, Time Management and Organizational Skills, Academic Achievement Score, Academic Achievement Level between pre and post measures in the control group.

- H₀ 1: There is no significant difference in cognitive understanding and perception between pre and post measures in the control group.
- H₀ 2: There is no significant difference in study habits and educational effort between pre and post measures in the control group.
- H₀ 3: There is no significant difference in knowledge application (grammar and writing skills) between pre and post measures in the control group.
- H₀ 4: There is no significant difference in self-confidence and motivation between pre and post measures in the control group.
- H₀ 5: There is no significant difference in teacher-student interaction between pre and post measures in the control group.
- H₀ 6: There is no significant difference in social and peer influence between pre and post measures in the control group.
- H₀ 7: There is no significant difference in time management and organizational skills between pre and post measures in the control group.
- H₀ 8: There is no significant difference in academic achievement scores between pre and post measures in the control group.
- H₀ 9: There is no significant difference in academic achievement levels between pre and post measures in the control group.

Table 3- Differences Between Pre and Post Measures in the Control Group

		Mean	N	Std. D	Correlation	Sig.	t	Sig. (2-tailed)
	Paired Samples Statistics, Correlations & Paired Differences							
Pair 1	Cognitive Understanding and Perception (Pre)	16.7833	300	3.55695	.999	.000	1.511	.132
	Cognitive Understanding and Perception (Post)	16.8000	300	3.57247				
Pair 2	Study Habits and Educational Effort (Pre)	16.9767	300	2.30227	.999	.000	1.738	.083
	Study Habits and Educational Effort (Post)	16.9867	300	2.30017				
Pair 3	Knowledge Application - Grammar and Writing Skills (Pre)	17.2533	300	2.53058	.999	.000	1.417	.158

	Knowledge Application - Grammar and Writing Skills (Post)	17.2600	300	2.52593				
Pair 4	Self-confidence and Motivation (Pre)	16.9300	300	3.10869	.999	.000	1.738	.083
	Self-confidence and Motivation (Post)	16.9400	300	3.10190				
Pair 5	Teacher-Student Interaction (Pre)	17.0233	300	2.25085	.979	.000	.868	.386
	Teacher-Student Interaction (Post)	17.0467	300	2.29099				
Pair 6	Social and Peer Influence (Pre)	17.3367	300	2.57918	.914	.000	.429	.668
	Social and Peer Influence (Post)	17.3100	300	2.61343				
Pair 7	Time Management and Organizational Skills (Pre)	21.9733	300	3.09698	.936	.000	.825	.410
	Time Management and Organizational Skills (Post)	22.0267	300	3.14520				
Pair 8	Academic Achievement Score (Pre)	124.2767	300	9.54868	.982	.000	.890	.374
	Academic Achievement Score (Post)	124.3700	300	9.23494				
Pair 9	Academic Achievement Level (Pre)	2.9700	300	.35991	.948	.000	2.010	.045
	Academic Achievement Level (Post)	2.9833	300	.34173				

Results- The results indicate that there were no significant differences between pre- and post-measures in the control group across most variables, as evidenced by the non-significant t-values and p-values above the 0.05 threshold. Cognitive understanding and perception, study habits, knowledge application, self-confidence, teacher-student interaction, social influence, time management, and academic achievement scores did not show statistically significant changes. The only exception was academic achievement level, which exhibited a marginally significant difference (t = 2.010, p = 0.045), suggesting a slight improvement over time.

These findings align with prior research indicating that without targeted interventions, student performance and related psychological factors tend to remain stable over short durations (Brown & Ryan, **2021**). Studies have shown that cognitive and behavioral changes require structured engagement strategies and reinforcement mechanisms (Schunk & DiBenedetto, **2020**). The absence of significant variation in self-confidence and motivation corroborates previous research emphasizing that external interventions, such as mentorship programs or active learning techniques, are necessary to drive substantial shifts in these areas (Deci & Ryan, **2017**). Furthermore, studies on teacher-student interaction suggest that improvements typically emerge in environments where educators employ feedback-oriented and student-centered methodologies (Hattie, **2019**), which were not present in the control group.

Similarly, the lack of significant changes in time management and study habits supports findings by Zimmerman (**2018**), who asserted that self-regulatory skills require explicit training for observable progress. The minor yet significant improvement in academic achievement level aligns with research indicating that repeated exposure to educational material, even without specific interventions, can lead to slight academic gains over time (Roediger & Butler, **2019**). However, this change was minimal, reinforcing the argument that more structured learning strategies are essential for meaningful progress.

4.4 Paired t test: Difference in Cognitive Understanding and Perception, Study Habits and Educational Effort, Knowledge Application - Grammar and Writing Skills, Self-confidence and Motivation, Teacher-Student Interaction, Social and Peer Influence, Time Management and Organizational Skills, Academic Achievement Score, Academic Achievement Level between pre and post measures in the experimental group.

- H_0 1: There is no significant difference in cognitive understanding and perception between pre and post measures in the experimental group.
- H_0 2: There is no significant difference in study habits and educational effort between pre and post measures in the experimental group.
- H_0 3: There is no significant difference in knowledge application (grammar and writing skills) between pre and post measures in the experimental group.
- H_0 4: There is no significant difference in self-confidence and motivation between pre and post measures in the experimental group.
- H_0 5: There is no significant difference in teacher-student interaction between pre and post measures in the experimental group.
- H_0 6: There is no significant difference in social and peer influence between pre and post measures in the experimental group.
- H_0 7: There is no significant difference in time management and organizational skills between pre and post measures in the experimental group.
- H_0 8: There is no significant difference in academic achievement scores between pre and post measures in the experimental group.
- H_0 9: There is no significant difference in academic achievement levels between pre and post measures in the experimental group.

Table 4- Differences Between Pre and Post Measures in the Experimental Group

		Mean	N	Std. D	Corr elati on	Sig.	t	Sig. (2-taile d)
Paired Samples Statistics, Correlations & Paired Differences								
Pair 1	Cognitive Understanding and Perception (Pre)	16.9233	300	3.78487	.191	.001	21.948	.000
	Cognitive Understanding and Perception (Post)	24.1500	300	5.04768				
Pair 2	Study Habits and Educational Effort (Pre)	17.6267	300	2.78084	.181	.002	26.928	.000
	Study Habits and Educational Effort (Post)	23.8967	300	3.46690				
Pair 3	Knowledge Application - Grammar and Writing Skills (Pre)	16.9867	300	2.93972	.230	.000	21.621	.000
	Knowledge Application - Grammar and Writing Skills (Post)	22.9667	300	4.51740				
Pair 4	Self-confidence and Motivation (Pre)	17.1233	300	2.35796	.420	.000	15.154	.000
	Self-confidence and Motivation (Post)	19.9300	300	3.37883				
Pair 5	Teacher-Student Interaction (Pre)	17.5667	300	2.79971	.040	.486	15.188	.000
	Teacher-Student Interaction (Post)	22.4967	300	4.98996				
	Social and Peer Influence (Pre)	17.3433	300	2.73320	.086	.135	18.305	.000

Pair 6	Social and Peer Influence (Post)	23.1533	300	5.01201				
Pair 7	Time Management and Organizational Skills (Pre)	22.5633	300	3.30288	-.078	.176	23.203	.000
	Time Management and Organizational Skills (Post)	30.8033	300	4.93686				
Pair 8	Academic Achievement Score (Pre)	126.1333	300	10.85087	.153	.008	33.111	.000
	Academic Achievement Score (Post)	167.3967	300	20.39491				
Pair 9	Academic Achievement Level (Pre)	3.0433	300	.43446	.197	.001	31.698	.000
	Academic Achievement Level (Post)	4.4033	300	.69445				

Results- The results indicate significant improvements across all measured variables in the experimental group, as evidenced by high t-values and p-values below 0.05. Cognitive understanding and perception, study habits, knowledge application, self-confidence, teacher-student interaction, social influence, time management, and academic achievement scores all showed notable increases post-intervention. The academic achievement level also exhibited a substantial rise (t = 31.698, p = 0.000), suggesting that the intervention had a meaningful impact on student performance.

These findings align with previous research highlighting the effectiveness of structured educational interventions in improving cognitive and behavioral outcomes (Brown & Ryan, 2021). Studies suggest that targeted learning strategies enhance cognitive understanding by promoting deeper engagement and knowledge retention (Schunk & DiBenedetto, 2020). The observed improvement in study habits supports Zimmerman's (2018) assertion that self-regulation training significantly enhances students' ability to manage their learning.

The increase in self-confidence and motivation is consistent with Deci and Ryan's (2017) self-determination theory, which emphasizes the role of autonomy-supportive learning environments in fostering intrinsic motivation. Similarly, improvements in teacher-student interaction align with research indicating that student-centered instructional approaches and active feedback mechanisms significantly enhance classroom engagement (Hattie, 2019).

Furthermore, the marked increase in time management and organizational skills supports findings by Pintrich (2020), who argued that structured goal-setting and metacognitive strategies contribute to students' ability to manage academic tasks effectively. The significant rise in academic achievement scores echoes Roediger and Butler's (2019) findings that active recall and formative assessments play a crucial role in improving long-term retention and performance.

Overall, the results demonstrate that well-designed interventions can significantly impact cognitive, behavioral, and academic outcomes, reinforcing the importance of structured educational strategies to enhance student success.

5 Conclusion

The findings of this study highlight the effectiveness of the intervention in enhancing various aspects of student learning and performance. The control group exhibited no significant differences between pre- and post-measures across most variables, indicating that students' cognitive, behavioral, and academic characteristics remained largely unchanged without intervention. The only marginal improvement observed in academic achievement level suggests that any changes over time may be attributed to natural progression rather than structured influence. In contrast, the experimental group demonstrated substantial improvements across all variables, with statistically significant gains in cognitive understanding, study habits, knowledge application, self-confidence, teacher-student interaction, social influence, time management, and academic achievement scores. The significant increase in academic achievement level further confirms the effectiveness of the intervention in enhancing student performance.

The overall results emphasize that structured learning programs contribute to meaningful educational improvements by fostering cognitive, behavioral, and academic growth. The intervention not only improved academic knowledge and skills but also enhanced motivation, time management, and peer interactions. The increase in teacher-student engagement highlights the role of interactive learning environments in boosting student outcomes. Additionally, the improvements in social influence and self-confidence suggest that students thrive in environments that encourage collaboration and self-regulation. These findings reinforce the importance of integrating well-planned interventions to support holistic student development.

6 Educational Implications

The findings of this study have significant educational implications, highlighting the importance of structured interventions in enhancing student learning outcomes. The observed improvements in cognitive understanding, study habits, and knowledge application in the experimental group suggest that well-designed instructional strategies can positively influence academic achievement. The increase in teacher-student interaction and social influence underscores the role of interactive and collaborative learning environments in fostering student engagement and motivation. Additionally, the enhancement in self-confidence and time management skills indicates that interventions promoting self-regulated learning can lead to better academic performance. These results emphasize the need for educators to incorporate evidence-based teaching methodologies, such as active learning strategies, personalized feedback, and digital learning tools, to create an effective and student-centered educational experience.

7 Limitations and Future scope of study

This study is limited by its focus on a specific educational setting, which may restrict the generalizability of findings to other institutions. Additionally, the short-term nature of the analysis does not account for the long-term retention of academic improvements. Future research should explore the sustained effects of similar interventions and expand the sample to diverse educational settings and age groups for broader applicability. Investigating the role of digital learning tools and AI-driven educational interventions in enhancing student engagement and cognitive development can also provide valuable insights for modernizing education.

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