Impact of Blended Learning Teaching Technique on Students' Academic Achievement at Elementary Level

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Abstract

The increasing demands on teachers have led to the strategic integration of information communication technology, suggesting that teachers' effectiveness can be heightened through the judicious incorporation of technology into their teaching techniques. In light of this premise, this research aimed to assess the impact of blending learning teaching techniques on the academic achievement of 8th class science subject students in district Gujranwala, Pakistan. The main objective was to compare students' achievement levels between blending learning and traditional methods. A pre-test post-test control group design was utilized, with a sample of sixty students who were randomly selected. Data were collected through achievement test, revealing blending learnings' superiority in enhancing students' cognitive skills according to Bloom's taxonomy. Results revealed the potential benefits of incorporating blending learning in development of education at the elementary level.

Keywords: *Blended Learning (BL), Information Communication Technology (ICT), Elementary level, Teaching techniques, Bloom's taxonomy, Traditional teaching methods.*

Introduction

Challenges in implementing e-learning are prominent in developing countries like Pakistan due to issues such as power outages, computer illiteracy, and limited access to technological devices and the internet. Consequently, the integration of Information and Communication Technology (ICT) in the country's education system is hindered. Furthermore, insufficient staff and basic infrastructure in both rural and urban public sector schools indicate a lack of prioritization of education in government policies. These challenges have spurred local researchers to focus on studies regarding ICT integration in education or evaluating the accessibility and availability of essential infrastructure for ICT integration in higher education.

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In this context, the researchers aimed to investigate whether Blended Learning (BL) enhances the academic performance of students at the elementary level, which serves as a crucial stage for further education. Previous research by McCue (2014) highlighted that BL contributed to the development of teachers' analytical and evaluative skills by engaging them with relevant lesson content.

In developing nations, the utilization of Information and Communication Technology (ICT) remains in its nascent stages primarily due to resource constraints (Barbour et al., 2011). Recognizing the imperative to elevate educational standards to international benchmarks, the Higher Education Commission (HEC) of Pakistan embarked on an ambitious journey to digitize the education system (Rahman, 2007). Subsequently, the government, particularly the provincial government of Punjab, intensified its efforts to address these challenges, notably by focusing on the appointment of Information Technology (IT) personnel and establishing IT laboratories in secondary schools across the province during the fiscal year 2010-15 (Kundi, Nawaz, & Khan, 2010). A significant stride was made between 2010-2017, as numerous high and higher secondary schools were outfitted with IT labs, supplemented by the installation of interactive whiteboard smart screens in various districts. To mitigate the impact of electricity outages, solar panels were also integrated into these systems. The vision extended beyond mere infrastructure enhancement; efforts were made to revamp the curriculum, with the Directorate of Curriculum and Teacher Education (DCTE) spearheading the transition from traditional blackboards to smart screens. This strategic shift prompted the DCTE to launch an extensive Blended Learning (BL) initiative, aimed at equipping primary school teachers with the necessary skills to effectively integrate ICT into the educational landscape. Through these concerted endeavors, Pakistan endeavors to bridge the digital divide and unlock the transformative potential of technology in education.

The efficacy of the provincial government of Punjab's efforts in supporting public sector elementary school teachers within the province prompts inquiry. As contrasting perspectives on the effectiveness of blended learning in pedagogical approaches persist, more questions emerge than answers. Consequently, a decision was made to scrutinize whether a tangible correlation exists between blended learning instruction and the practices of elementary school teachers. This endeavor aims to shed light on the ongoing discourse surrounding elementary school education, serving as a valuable supplement to existing literature in the field.

Statement of the Problem

Implementing e-learning faces significant challenges in countries like Pakistan, including power outages, computer illiteracy, and limited access to technology and the internet. The study investigates how blending learning techniques affect academic achievement in elementary students. By comparing them with traditional methods, it assesses cognitive skill development based on Bloom's taxonomy. The findings endorse integrating blending learning into elementary education to maximize students' academic success. Hence, it was imperative to conduct a study on "Impact of Blended Learning Teaching Technique on Students Academic Achievement at Elementary Level".

Objectives of the Study

1. To evaluate 8th-class science students' academic achievement under blended learning teaching techniques and traditional methods.
2. To investigate the impact of blended learning teaching techniques and traditional teaching on cognitive development of 8th class science students.

Hypotheses

1. There is no significant difference in the academic achievement of 8th class science students between those undergoing blended learning teaching techniques and those taught using traditional methods.
2. There is no significant difference in the cognitive development of 8th class science students based on the instructional method, whether blended learning teaching techniques or traditional teaching, as measured by cognitive levels.

Significance of the Study

In Pakistan, where e-learning faces formidable obstacles like power outages and limited technological access, understanding how Blended Learning (BL) techniques impact elementary education is paramount. Researching the impact of blended learning on elementary students' academic achievements was significant for several reasons. Firstly, it provided insights into the effectiveness of integrating technology with traditional teaching methods, potentially improving learning outcomes for students. Secondly, it enabled educators to tailor learning experiences to meet individual student needs, fostering a more personalized approach to education. Thirdly, it prepared students for the increasingly digitalized world by equipping them with essential technological skills from an early age. Additionally, understanding the impact of blended learning helped in optimizing resource allocation within

educational institutions, ensuring efficient use of technology and training resources. Furthermore, it supported the professional development of teachers by identifying effective strategies for integrating technology into their teaching practices. Lastly, researching the effects of blended learning contributed to addressing achievement gaps and promoting equity in education by providing diverse learners with equal access to effective learning tools and methods. Overall, this research had far-reaching implications for improving educational practices and student outcomes.

Delimitations of the Study

The study was delimited to focus solely 8th class students at a girls' public school in Gujranwala during the academic session 2023-24. The research concentrated on four selected chapters from a science textbook over a specific timeframe of eight weeks.

Literature Review

The term "e-learning" emerged in the 1980s (Bersin, 2004) alongside the rise of online and distance learning, providing educational access to individuals unable to attend traditional classrooms. However, it is essential to recognize that e-learning encompasses more than just distance teaching (Moore, Dickson-Deane, & Galyen, 2011). The integration of e-learning into traditional classroom settings has proven to be more productive than standalone e-learning platforms. E-learning tools enable practitioners and learners to access course content conveniently, even outside of school premises. Simultaneously, face-to-face interactions in traditional classrooms offer learners opportunities to reinforce messages and engage directly with teachers and peers.

Numerous researchers (e.g., Doom, 2016) have successfully implemented e-learning within face-to-face classroom environments, demonstrating that combining these two modes creates an educational environment conducive to frequent access, comprehensive disclosure of educational material, and enhanced teaching and learning skills. This integration of learning approaches gave rise to the concept of Blended Learning.

Since 2000, the integration of internet technology into education has marked a significant milestone (Picciano, 2014). It has evolved beyond merely facilitating distance learning to becoming a fundamental educational tool at all levels within American schools. The blending of internet-based and traditional pedagogies in curriculum development has proven instrumental in aiding students' academic course

completion (Hui, 2016). Graham, Woodfield, and Harrison (2013) further examined how online learning serves as a catalyst for enhancing routine teaching and learning practices.

Previous research has showcased the successful implementation of the Blended Learning (BL) approach in high school education within developed countries (Hill, 2015) thereby encouraging its adoption in developing nations. This shift, recognizing teachers as pivotal stakeholders, underscores the need for educators to evaluate and adapt their instructional strategies to equip themselves with the necessary skills to navigate technological advancements in education. Consequently, teachers must augment their efforts to enhance their adaptability and proficiency in aligning with learners' needs and embracing technology-driven educational methodologies. This evolution distinguishes 21st century educators from their 20th century counterparts. In light of this, there is a call for more empirical studies (Means, Toyama, Murphy, & Baki, 2013) to be conducted to enhance the teaching experiences of less-experienced or technologically adept teachers in utilizing the BL approach within their instructional practices.

Staker and Horn (2012) identified several driving forces behind the emergence of Blended Learning (BL) in education, including budget constraints, teacher shortages, legislative mandates like 'No Child Left Behind,' students' proficiency levels in core subjects, retention rates, and the provision of tutoring both in school and at home. Additionally, other factors propelling the integration of technology in education include the imperative to raise student achievement, time constraints within traditional classroom settings, surging student populations facilitated by open enrollment policies (McAlister, 2013) and alarmingly high dropout rates.

One significant challenge for teacher is bridging the gap between teaching practices and learning activities (Ololube, 2015). The pedagogical shift brought about by BL creates a conducive learning environment, seamlessly integrating technology into the educational landscape. The incorporation of technology into the online format of BL not only enhances teaching quality (Poon, 2013) but also facilitates collaborative efforts between students and teachers (Staker & Horn, 2012). BL equips schools with the tools to meet the contemporary demands of the modern era by leveraging innovative, research-based educational technologies to optimize the educational process.

The effective implementation of Blended Learning (BL) has been shown to enhance both teaching and learning capacities. However, It is crucial to recognize that technology should not be perceived as a substitute for teachers but rather as a vital tool for innovating teaching methodologies and streamlining time and effort (Doom, 2016). Both pedagogically and technically, the role of teachers remains indispensable for successfully implementing BL (Kaleta et al., 2007). BL facilitates student retention by fostering efficient interaction between students and teachers (Gomes, 2014), sustaining student interest through a diverse array of accessible technological resources, and integrating various modalities for content delivery. Additionally, BL aids in assessment customization for individualized assignments (Hudson, 2013).

However, adopting the BL approach presents significant challenges for teachers who are accustomed to traditional, teacher-centered lessons (Ololube, 2015). Technology does not compel teachers to abandon traditional pedagogies; rather, it empowers them to utilize technology to enrich students' learning experiences (Shahid, 2021). Teachers can cultivate a BL environment by employing various online instructional models in face-to-face classroom settings (Staker & Horn, 2012), as well as outside the school environment, such as the 'flipped technique,' which combines face-to-face interaction with online activities. Such interactive environments not only support teaching but also scaffold learning skills (Hui, 2016). The flexibility and convenience of BL allow teachers to develop diverse pathways for interactive and collaborative learning, even with limited resources such as a single iPad/tablet/whiteboard/computer for all students. It is noteworthy that the availability of technology does not automatically translate to its integration into teaching practices (Dwyer, 2016).

In preparation for working within a blended learning environment, a comprehensive examination of effective blended learning practices underscores the critical considerations that teachers must address. Oliver and Stallings (2014) emphasize three key factors that teachers need to take into account: the classroom context, pedagogical strategies, and the integration of technology. This research-based substantiation highlights the importance of understanding the specific dynamics of the class environment, such as student demographics and learning needs, as well as employing appropriate instructional approaches that align with blended learning principles. Additionally, teachers must skillfully leverage technology tools and resources to enhance the learning experience and facilitate effective communication and collaboration. By thoroughly considering these elements, educators can cultivate

readiness for implementing blended learning methods and optimizing educational outcomes in diverse learning environments.

Moreover technology-enhanced teaching roles were evaluated in a Blended Learning (BL) context at Government High School, KPK. Surveying 9th class physics students and science teachers. Findings suggested improved practices, advocating for BL adoption over conventional methods, aligning with the strategic integration of technology in education (Asif, Edirisingha, Ali, & Shehzad, 2020). Before the advent of online and blended teaching, technology educational training primarily centered on integrating technology into classroom instruction, as noted by Graham et al. (2013). These researchers elucidated that the traditional mode of instruction focused on imparting skills that emphasized students' interaction with digital content. Conversely, online teaching introduced a physical disconnect between teachers and students, emphasizing communication skills and engagement with both digital and non-digital content. The amalgamation of skills from the traditional and online teaching models forms the foundation of a blended teaching model.

In summary, research lacks empirical evidence on effectively supporting less-experienced teachers in implementing Blended Learning (BL) in resource-constrained settings like Pakistan. Understanding how to optimize BL for these educators is crucial for enhancing teaching experiences and student outcomes at elementary level in the digital age.

Research Methodology

This research study adopted a quantitative approach, utilizing an experimental method within the framework of a positivistic paradigm, as outlined by Creswell (2014). This approach ensured fairness and impartial selection while effectively controlling for extraneous variables. To minimize potential issues with the accuracy of the research findings, the researchers used the pretest-posttest control group design. In this study, two groups (control and experimental) were equally matched through random sampling. The study employed an experimental method with a pre-test post-test control group design, symbolized as follows.

$$R_E = \quad O_1 \text{ ——— } T \text{ ——— } O_2$$

$$R_C = \quad O_3 \text{ ——————— } O_4$$

Where,

O_1 and O_3 = Pretests

O_2 and O_4 = Posttests

R for randomization

E for experimental group, C for control group

T for treatment (BL method)

The study followed an experimental approach, the target population encompassed all 8th class girls of public schools in district Gujranwala, while the accessible population included those in one Tehsil selected public school. Participants shared similar backgrounds, ages (13-14years), socioeconomic statuses, and cultural characteristics. A sample of sixty 8th class students was randomly selected from a government girl's high school in Gujranwala city, divided into experimental and control groups. The group formed and with random assignment of teaching methodologies to each group. This approach ensured a systematic investigation into the impact of the blended teaching techniques.

Table 1

Selected Girls Students of Control and Experimental Group of 8th Class

School Name	Control Group	Experimental Group	Total Students
GGHS City Gujranwala	30	30	60

Developing a reliable and valid test was crucial for assessing students' learning effectively. At the elementary level, foundational for further learning. The researchers carefully crafted questions from selected chapters of the 8th class science aligned with learning outcomes and Bloom's taxonomy, drawing on subject expertise and educational frameworks. Through an item analysis, questions were refined to ensure clarity and fairness. Content validity was verified by experts, while reliability was assessed through the test-retest method to ensure consistent results over time. Additionally, a pilot study with students from another school validated the test's effectiveness before implementation. This rigorous approach ensured that the test accurately measured students' understanding of the material, providing educators with valuable insights into student learning outcomes.

In this study, the use of the blended teaching technique served as the independent variable, while students' achievement in science was the dependent variable. Control variables included class level, timing, teacher, classroom conditions, and course content consistency. Uncontrolled variables encompassed learners' IQ,

individual inclinations towards the subject, and student tuition practices beyond the researcher's control, potentially impacting test scores.

The experimental group taught through Blended Learning (BL) teaching techniques, teacher conducted lessons on four chapters of 8th class General science using web pages as the primary platform. The research spanned eight weeks, with classes held five out of seven days each week, consisting of 40-minute periods. Instruction encompassed a blend of theoretical and practical activities, aiming to cover review sessions, introduce new content, and facilitate hands-on application. Within the classroom, teacher utilized a White Interaction Board in the computer lab to access internet sites, online video lectures, and demonstrate practical activities. Additionally, to supplement the web pages, course materials were distributed via email, WhatsApp, and imo accounts, fostering communication and collaboration among students and teachers outside of the classroom setting. In contrast, the control group will receive instruction through traditional teaching methods.

Data Collection

The researchers personally collected the data through pre-test was given before the treatment period and post-test after treatment period in order to determine the effectiveness of treatment period.

Data Analysis and Findings

Comparison of students' academic achievements on post-test and pre-test of control group

Table No 2

Calculation of Students' Academic Achievement on Post-test and Pre-test of Control Group.

Groups	N	Mean	SD	t-value	df	Sig/p-value
Posttest control Group	30	19.75	3.247	1.927	28	.055
Pretest control Group	30	17.68	4.002			

Table 2 displays the mean post-test score of 19.75 and SD of 3.247 for the control group. The control group's pre-test score had a mean of 17.68 and an SD of 4.002. In contrast to the table value of 2.16, which is less than the t-value at the 0.05 level of significance, the computed t-value for degree of freedom 28 is 1.927. Thus, it

can be said that students who were taught using a typical form of instruction had roughly the same recall capacity in both the pre- and post-tests.

Comparison of students' academic achievement on post-test and pre-test of experimental group

Table No 3

Calculation of Students' Academic Achievements on Post-test and Pre-test of Experimental Group

Groups	N	Mean	SD	t-value	*df*	Sig/p-value
Posttest Experimental Group	30	47.99	3.251	36.891	28	.000
Pretest Experimental Group		30	19.01	5.236		

Table 3 shows that the experimental group post-test mean score was 47.99 with a standard deviation of 3.251. These results suggest that the data are generally near the set mean. The experimental group pre-test mean is 19.01, and the standard deviation is 5.236, suggesting that the data are dispersed across a broader range of values. In contrast to the table value of 2.16, which is not larger than the t-value at the 0.05 level, the computed t-value for degree of freedom 28 is 36.891. Since the computed t-value is less than the table value and Ho1 is rejected, it can be said that students who receive instruction using blended learning methodologies had a significant improvement in their academic performance.

Comparison of the performance through cognitive levels of pretest of both groups

Table 4

Cognitive Levels Comparison of Students' Performance on Pre-test of Control and Experimental Groups

Cognitive Level	Group	N	Mean	*df*	t-value
Knowledge	Control	30	4.13	58	-.130
	Experimental	30	4.07		
Comprehension	Control	30	2.53	58	1.00
	Experimental	30	3.00		

Application	Control	30	4.00	58	-.548
	Experimental	30	3.73		
Analysis	Control	30	4.87	58	.649
	Experimental	30	5.13		
Synthesis	Control	30	2.93	58	-.484
	Experimental	30	2.67		

Table 4 shows that observed values in the domains of knowledge, understanding, application, analysis, and synthesis are consistently less than the critical value at the 0.05 level of significance for degree of freedom (df) 58. In particular, the observed values for knowledge, understanding, application, analysis, and synthesis are 1.30, 1.00, -0.548, 0.649, and -0.484, respectively, all of which are below the critical threshold of 2.00. This suggests that the mean scores of the experimental and control groups in these cognitive domains do not differ statistically significantly. Thus, it can be said that throughout the pre-test phase, both groups' performance in these cognitive domains was comparable.

Comparison of the performance through cognitive levels of posttest of both groups

Table 5

Cognitive Levels Comparison of Students' Performance on Post-test of Control and Experimental Groups

Cognitive Level	Group	N	Mean	SD	t-value	*df*	Sig/P value
Knowledge	Control	30	3.87	1.813	17.443	58	0.000
	Experimental	30	9.87	0.506			
Comprehension	Control	30	4.73	1.856	11.828	58	0.000
	Experimental	30	9.47	0.167			
Application	Control	30	3.80	1.919	16.320	58	0.000
	Experimental	30	9.80	0.610			
Analysis	Control	30	4.20	1.690	17.072	58	0.000
	Experimental	30	9.80	0.610			
Synthesis	Control	30	3.40	1.831	18.644	58	0.000
	Experimental	30	9.87	0.507			

There are some startling conclusions in the above table. The control group's post-test average in the knowledge domain is 3.87, with a standard deviation of 1.814 indicating a wide range of scores. The experimental group, on the other hand, has a substantially higher average score of 9.87 and a slightly smaller standard deviation of 0.507, suggesting that their scores are narrowly distributed around the mean. Similarly, in the understanding domain, the experimental group scores significantly higher at 9.47 with a lesser standard deviation of 1.167, compared to the control group's 4.73 with a 1.856 standard deviation. The experimental group's mean score in the application domain is 9.80, with a tighter standard deviation of 0.610, compared to the control group's 3.80 with a standard deviation of 1.919. Furthermore, the experimental group's mean score in the analysis domain is substantially higher at 9.80 with a narrower standard deviation of 0.610 than the control group's 4.20 with a 1.690 standard deviation. In conclusion, the experimental group scored 9.87 with a standard deviation of 0.507 in the synthesis domain, while the control group scored 3.40 with a standard deviation of 1.831. These findings demonstrate that across all cognitive skill domains, the experimental group outperformed the control group on a regular basis. Thus, based on their respective teaching strategies, we reject the hypothesis that there is no discernible difference in the cognitive development of the two groups of eighth-grade science students. Rather, it is evident that compared to the control group, pupils in the experimental group outperformed them in terms of cognitive ability as determined by Bloom's taxonomy.

Discussion

The data analysis presents compelling evidence regarding the efficacy of blended teaching techniques over traditional teaching methods in enhancing academic achievement and cognitive development. In Table 2, the control group's minimal improvement from pre-test to post-test suggests the limitations of conventional teaching approaches in facilitating meaningful learning outcomes. Conversely, Table 3 highlights the substantial improvement in the experimental group's post-test scores, indicating the positive impact of blended learning teaching techniques on student performance. The significant difference in t-values between the experimental and control groups underscores the superiority of blended learning teaching methods in fostering academic growth.

Table 4 reinforces these findings by revealing consistent performance across cognitive domains for both groups, implying comparable baseline cognitive

development. This consistency further emphasizes the distinct advantage of blended learning in driving significant improvements in student outcomes.

Table 5 emphasized that higher performance of cognitive skills according to Bloom's taxonomy compared to those in the control group. This demonstrated further emphasizes the distinct advantage of blended learning in driving significant improvements in student outcomes.

Blended learning's flexibility, interactivity, and personalized learning experiences likely contribute to its effectiveness in engaging students and promoting deeper understanding. By integrating technology with traditional teaching methods, educators can tailor instruction to meet diverse learning needs, ultimately leading to enhanced cognitive development and academic success.

Conclusion

In conclusion, the findings from the data analysis strongly support the adoption of blended learning teaching approaches as a superior alternative to traditional teaching methods. Blended learning not only significantly enhances academic achievement but also fosters cognitive development across various domains. The substantial improvement observed in the experimental group's posttest scores, coupled with the consistent performance across cognitive skills according to Bloom's taxonomy, underscores the transformative potential of blended learning in education. Moving forward, educators and policymakers should prioritize the integration of technology and innovative instructional strategies to generate dynamic learning situations that provide to the various needs of students. Embracing blended learning as a cornerstone of educational practice holds promise for empowering learners, enriching teaching experiences, and driving positive educational outcomes in the digital age.

Recommendations

Based on the findings and conclusions, consequent suggestions are presented:

1. Integrate BL courses into teacher training programs, particularly at the elementary level, to enhance teaching quality and student engagement.
2. Ensure BL training is inclusive of all subjects and not limited to science teachers, benefiting all elementary-level educators.
3. Encourage experts in curriculum development and educational policymakers to prioritize the integration of BL techniques to improve educational outcomes.

4. Provide resources and support for teachers to effectively implement BL strategies in their classrooms, fostering a conducive learning environment.
5. Continuous evaluation and adaptation of BL practices based on feedback from teachers and students to ensure its effectiveness in enhancing teaching and learning experiences.

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