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Enhancing Formal Written Communication Skills Through Mobile-Assisted Language Learning: A Quasi-Experimental Study

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ABSTRACT

This quasi-experimental study, employing a non-equivalent control group pretest/post-test design and grounded in Ecological Constructivism, investigates the impact of a Mobile-Assisted Language Learning (MALL) intervention on Formal Written Communication Skills (FWCS) among undergraduate business communication students at a private Pakistani university. Using a quantitative approach, the study assessed MALL's effectiveness by utilizing apps like Grammarly and Google Docs for real-time feedback, through pre- and post-test evaluations of experimental and control groups. Paired t-tests revealed significant improvements in FWCS, including content/structure, business vocabulary, and grammar/syntax, but no improvement in spelling, likely due to reliance on autocorrect and informal texting habits. These findings align with prior research (Bashir et al., 2020; Moghal et al., 2020; Mubeen et al., 2021), which highlights the role of mobile learning in enhancing engagement, accessibility, and learner autonomy through self-paced practice and peer feedback. In Pakistan's resource-constrained higher education, MALL offers scalable solutions for writing proficiency, though the lack of progress in spelling underscores the need for targeted exercises. Limitations, including the short intervention and single-institution focus, suggest the need for longitudinal, multi-institutional studies to explore spelling-focused mobile application learning (MALL) and contextual factors such as prior mobile use. The study advocates for structured MALL integration into business communication curricula, combining

mobile apps with traditional spelling drills to address all FWCS components effectively, offering valuable insights for academic and professional writing instruction in resource-limited contexts.

Keywords: Mobile-Assisted Language Learning (MALL), Formal Written Communication Skills (FWCS), Business Communication, Mobile Phone Intervention, Higher Education, Educational Technology, MALL in Pakistan

INTRODUCTION

Proficiency in formal written English is essential for academic and professional success, particularly in Pakistan, where English serves as a second official language and the primary medium of instruction in higher education (Rahman, 2020). However, undergraduate students often struggle with key writing components—such as business letter formatting, vocabulary, grammar, and organization—due to rote-based teaching methods and limited access to modern resources (Fareed et al., 2021; Haidar & Fang, 2019). These challenges underscore the need for innovative, skill-oriented pedagogies.

The global proliferation of mobile technology presents a transformative opportunity. With 5.16 billion internet users worldwide and 89.7% mobile penetration in Pakistan (Statista, 2023; PTA, 2023), Mobile-Assisted Language Learning (MALL) offers learner-centered tools, such as grammar checkers, collaborative platforms, and vocabulary apps, that promote autonomy and engagement (Kukulska-Hulme, 2020; Xodabande, 2017). While studies show MALL improves vocabulary and general language skills among Pakistani ESL learners (Bashir et al., 2020; Moghal et al., 2020), its impact on formal writing remains underexplored in higher education.

This study, grounded in Ecological Constructivism (Palalas, 2014), examines how a mobile phone-based intervention (MBI) affects the formal written communication skills (FWCS) of 90 undergraduate students in a business communication course at a private university in Karachi. Using a quasi-experimental design, it compares outcomes between a mobile-supported experimental group and a traditionally instructed control group across five FWCS components. The study aims to fill gaps in the literature by providing empirical evidence on MALL's potential to enhance formal writing, offering implications for curriculum integration in Pakistan and similar contexts.

Problem Statement

Formal written English skills are critical for academic achievement and professional success in Pakistan, where English serves as a key medium for higher education and business communication (Rahman, 2020). However, undergraduate students face significant obstacles in mastering these skills, hindered by traditional, rote-based teaching methods, scarce resources, and limited exposure to innovative pedagogies (Fareed et al., 2021; Haidar & Fang, 2019). Despite the widespread adoption of mobile phones, with 89.7% penetration in Pakistan (PTA, 2023), their

potential to enhance formal writing proficiency remains largely untapped. This study aims to address this gap by investigating how mobile-assisted language learning (MALL) can enhance the formal written communication skills of undergraduate students, providing a scalable solution to transform language education and empower learners for professional contexts.

Research Objectives

To assess the overall impact of mobile phone interventions on enhancing the formal written communication skills of undergraduate students enrolled in a business communication course at a private university in Pakistan.

1. To determine whether mobile phone interventions result in a significant improvement in the following specific components of formal written communication skills:
    a. Business Vocabulary (BV)
    b. Business Letter Format (BLF)
    c. Spelling Improvement (SI)
    d. Syntax and Grammar (SG)
    e. Coherence, Cohesion, and Organization (CCO)

Research Questions

1. How significantly has the intervention of mobile phones enhanced the formal written communication skills of undergraduate students enrolled in a business communication course at a private university in Pakistan?

a. What is the impact of mobile phone intervention on the Business Vocabulary (BV) component of formal written communication skills?

b. To what extent has mobile phone intervention influenced the Business Letter Format (BLF) component of formal written communication skills?

c. Does mobile phone intervention significantly improve Spelling (SI) within formal written communication skills?

d. How does mobile phone intervention affect the Syntax and Grammar (SG) component of formal written communication skills?

e. How has mobile phone intervention improved the Coherence, Cohesion, and Organization (CCO) component of formal written communication skills?

LITERATURE REVIEW

The integration of technology into education has transformed teaching and learning over the decades, evolving from basic tools like blackboards to sophisticated digital platforms. The advent of computers in the 1980s marked a significant shift, introducing computer-assisted instruction (CAI) and enabling individualized learning (Husain, 2010). The internet's emergence in the 1990s further revolutionized education by facilitating access to global resources and collaborative learning environments (Cub et al., 2001). Today, technology encompasses a wide array of tools, including multimedia, mobile devices, and artificial intelligence, which enhance engagement, accessibility, and personalization in education (Kopcha et al., 2020).

Technology has played a pivotal role in transforming language education by addressing the complexities of second language (L2) acquisition. Globally, tools such as audio-visual aids, language laboratories, and digital platforms have supported the development of the four core language skills reading, writing, speaking, and listening (Warschauer & Healey, 1998). The evolution from teacher-centred to learner-centred pedagogies has been significantly shaped by technological advancements, emphasising autonomy, collaboration, and real-world application (Kukulska-Hulme, 2020). In developing countries like Pakistan, where English is a crucial medium for academic and professional mobility, technology offers a scalable solution to bridge educational disparities (Huang et al., 2025; Doan & Huynh, 2024; Hsu et al., 2024).

In the Pakistani context, initiatives such as the Higher Education Commission's (HEC) National Digital Library have expanded access to scholarly resources, supporting both students and educators in enhancing English language proficiency (Mubeen et al., 2021). The widespread use of mobile phones, with a 2023 penetration rate of 89.7% (PTA, 2023), makes mobile-assisted language learning (MALL) a feasible intervention outside traditional classrooms (Hsu et al., 2025; Huang et al., 2025; Thu et al., 2024). However, systemic barriers, such as the digital divide, insufficient teacher training, and inconsistent internet access, particularly in rural regions, pose significant challenges to effective implementation (Irfan et al., 2022; Manzoor, 2020). These contextual realities necessitate locally responsive, inclusive strategies to fully leverage technology for English Language Teaching (ELT) across Pakistan's diverse educational landscape.

Developments in Educational Technologies: ICT, CALL, and MALL

Information and Communication Technology (ICT), Computer-Assisted Language Learning (CALL), and Mobile-Assisted Language Learning (MALL) have significantly influenced language education by enhancing interactivity, accessibility, and learner autonomy. ICT, encompassing tools such as computers, internet platforms, and multimedia resources, fosters dynamic learning environments and supports data-informed pedagogy (Kotrlik & Redmann, 2009; Hew & Brush, 2007). In Pakistan, ICT integration is promoted through initiatives such as smart classrooms; however, challenges persist, including poor infrastructure and insufficient teacher training, especially in schools (Khan & Qureshi, 2024).

CALL utilizes computer-based tools to facilitate language acquisition, grounded in multimedia learning theories that optimize retention through a combination of visual and auditory inputs (Mayer, 2009). While widely used to improve writing and vocabulary skills globally (Lim & Aryadoust, 2021), its application has been largely limited to higher education in Pakistan, yielding promising but contextually narrow outcomes (Tariq, 2024).

MALL extends CALL by utilizing mobile devices for anytime, anywhere learning. It enables authentic practice and fosters learner autonomy via platforms like WhatsApp and Duolingo (Kukulska-Hulme, 2020). In Pakistan, MALL has been effective in improving vocabulary, grammar, and writing proficiency (Naz et al., 2023; Alam, 2024). However, barriers such as device limitations and digital

inequality continue to affect its broader adoption (Maharani, 2024; Stockwell & Hubbard, 2013).

Global and Pakistani Perspectives on Writing Approaches

Writing is a complex skill that integrates linguistic competence, critical thinking, and creativity. In academic and professional contexts, formal writing demands clarity and precision (Heylighen & Dewaele, 1999; Strunk & White, 2009). Globally, three dominant instructional approaches guide writing pedagogy. The process approach emphasizes recursive stages, planning, drafting, revising, and is enhanced by digital tools that support collaboration and feedback (Flower & Hayes, 1981; Graham & Rijlaarsdam, 2016). The product approach, while helpful in teaching structured genres such as business letters, prioritizes linguistic accuracy and has been critiqued for stifling creativity (Ellis, 1994; Zamel, 1983). In contrast, the genre-based approach (GBA) situates writing in social and functional contexts, teaching conventions through scaffolding and contextualized tasks, increasingly supported by mobile learning platforms (Hyland, 2023; Vygotsky, 1978; Ahmadi & Rostami, 2021).

In Pakistan, writing instruction often remains traditional and teacher-centered, emphasizing rote memorization over skill development (Fareed et al., 2021). However, the process approach is gaining traction in higher education, particularly through the integration of digital tools that enhance writing fluency and organization (Tariq, 2024). Although less widespread, GBA has shown promise in business communication contexts, particularly in teaching workplace genres like reports and proposals (Asad et al., 2020). Mobile-assisted language learning (MALL) supports process and genre approaches by facilitating real-time feedback and peer interaction. However, adoption is hindered by technological and training limitations (Halepoto et al., 2022). Recognizing Pakistan's linguistic diversity and resource variability, scholars like Naz et al. (2023) advocate for context-sensitive writing pedagogy tailored to local needs.

Theoretical Frameworks for Technology Integration in ELT

Technology integration in English Language Teaching (ELT) is grounded in several educational theories that explain how learners interact with digital tools. Traditional learning theories such as Behaviorism, Cognitivism, and Constructivism laid the foundation for early technology use in education. Behaviorism emphasizes learning through repetition and reinforcement (Skinner, 1954), while Cognitivism focuses on mental processes such as problem-solving and memory (Piaget, 1972). Constructivism, by contrast, regards learners as active participants who construct knowledge through interaction with their environment (Vygotsky, 1978). While these theories informed early computer-assisted instruction (CAI) and computer-assisted language learning (CALL), their linear models are less aligned with the fluid, socially embedded nature of modern digital learning environments (Zhang & Zou, 2020).

To address these limitations, Ecological Constructivism has emerged as a more context-sensitive approach. It emphasizes dynamic interactions among learners,

technologies, and socio-cultural systems, positioning mobile devices as part of the broader learning ecosystem (Palalas, 2014; Mishra & Sharma, 2019). In the context of MALL, this theory supports the idea that mobile tools can foster authentic, situated language learning, especially when embedded in real-life tasks (Frielick, 2004). In Pakistan, where educational inequalities persist, Ecological Constructivism offers a framework for developing inclusive digital environments that consider learners' linguistic, geographic, and technological realities (Irfan et al., 2022). This study adopts this lens to frame mobile phone-based interventions as contextually relevant tools for enhancing formal writing.

Complementing this perspective are applied technology integration models, such as the Technology Acceptance Model (TAM) and the SAMR model. TAM posits that technology adoption depends on users' perceptions of its usefulness and ease of use (Davis, 1989), a relevant concern in Pakistan where digital literacy gaps hinder MALL implementation (Rashid et al., 2020). The SAMR model (Puentedura, 2010) further categorizes technology use into four stages—substitution, augmentation, modification, and redefinition—helping educators map how MALL can evolve from mere replacement of traditional tools to transforming language instruction. Together, these theoretical frameworks provide a comprehensive foundation for integrating mobile technologies effectively in ELT settings.

Global and National Developments in Educational Technology and MALL

Recent years have witnessed rapid global advancements in educational technology, driven by innovations in artificial intelligence (AI), extended reality (XR), and flipped learning. A bibliometric review by Hwang et al. (2024) identified Mobile-Assisted Language Learning (MALL) and Digital Game-Based Learning (DGBL) as leading research fronts in Technology-Enhanced Language Learning (TELL), particularly in improving English writing skills. Flipped classrooms and Small Private Online Courses (SPOCs) have also gained traction for fostering learner autonomy (Wang et al., 2020), while XR technologies create immersive environments, albeit limited by high costs (ITONICS, 2024). Generative AI tools, such as ChatGPT, offer real-time feedback for writing but raise concerns about overreliance and academic integrity (Jeong, 2022).

In Pakistan, technological integration in education has advanced through initiatives such as the Higher Education Commission's Smart University Project and national e-content development efforts. Despite the growing adoption of ICT in urban universities, infrastructural challenges, particularly in rural areas, continue to hinder equitable access (Khan & Qureshi, 2024). A recent study by Ahmed et al. (2024) found high student satisfaction with ICT for academic purposes, although issues related to connectivity and digital literacy persist. Mobile-assisted language learning (MALL) research is increasingly prominent, with studies demonstrating gains in grammar and vocabulary acquisition through mobile apps and WhatsApp-based writing tasks (Naz et al., 2023; Alam, 2024). National events, such as the Huawei ICT Competition 2023–2024, underscore the efforts of both the government and the private sector to enhance teacher training and bridge the digital divide

(Huawei, 2024).

However, Pakistan's progress remains uneven. While urban institutions are leveraging ICT and MALL, rural areas lag due to persistent gaps in infrastructure and teacher readiness (Manzoor, 2020; Maharani, 2024). Although MALL's benefits in vocabulary and grammar are well-documented (Burston, 2013; Gillespie, 2020), its impact on formal writing, particularly in business communication skills, remains underexplored. Most local studies lack empirical rigor or focus on general English as a second language (ESL) contexts (Lim & Aryadoust, 2021). As a result, calls for policy reform emphasize not only improved infrastructure but also localized, teacher-supported implementation of digital tools (Rashid et al., 2020; Zaho et al., 2025). Addressing these gaps, the current study contributes to the literature by empirically investigating the role of MALL in enhancing formal written communication skills among Pakistani undergraduates through a structured, context-sensitive mobile phone intervention.

METHODOLOGY

This quantitative, quasi-experimental study investigated the impact of Mobile-Based Interventions (MBI) on Formal Written Communication Skills (FWCS) among undergraduate Business Communication students at a private university in Karachi. Participants were assigned to intact experimental and control groups without randomization, following standard practice in educational research (Creswell & Creswell, 2023). The intervention spanned eight weeks and was guided by the SAMR model (Puentedura, 2010), which informed the integration of mobile tools across four levels: Substitution, Augmentation, Modification, and Redefinition. Pre- and post-tests assessed five FWCS components: Business Letter Format (BLF), Business Vocabulary (BV), Spelling Improvement (SI), Syntax and Grammar (SG), and Coherence, Cohesion, and Organization (CCO).

Sampling

Out of approximately 225 fourth-semester students, 90 were purposively selected based on completion of Academic Writing II and smartphone access (Etikan et al., 2016). Two intact groups were selected, one assigned as the experimental group (n = 45) and the other as the control group (n = 45). Participants were aged 19–20, with a gender distribution of 45% female and 55% male, and all had access to internet-enabled smartphones.

Data Collection Procedures

Both groups took a pre-test, a 50-mark sales letter assessed across the five FWCS components using a rubric adapted from Guffey and Loewy (2019). Three trained instructors independently graded all responses, and inter-rater reliability was high ($\kappa = 0.83$). The control group received traditional instruction, while the experimental group engaged in 24 hours of instruction using mobile tools based on the SAMR model:

- Substitution: Access to materials via Google Classroom.

- Augmentation: Use of Grammarly and online dictionaries for instant feedback.
- Modification: Peer editing in WhatsApp groups.
- Redefinition: Creating and sharing digital business proposals online.

These tools were integrated into regular sessions and supported by asynchronous mobile tasks to foster collaboration and self-directed learning (Palalas, 2014). Both groups completed a post-test using the same rubric; responses were anonymized, and inter-rater reliability remained strong ($\kappa = 0.85$).

Data Analysis

SPSS v26 was used for analysis. Descriptive statistics summarized scores, and normality and variance assumptions were confirmed via Shapiro-Wilk and Levene's tests ($p > .05$). Paired-samples *t*-tests assessed within-group changes; independent *t*-tests compared group means. A Bonferroni correction adjusted the alpha level to .01. Cohen's *d* measured effect sizes (Cohen, 1988), and ANCOVA was applied using pre-test scores as a covariate to refine group comparisons.

Ethical Considerations

The study followed institutional ethical protocols. Informed consent ensured transparency and voluntary participation. Anonymized grading and secure data storage protected confidentiality. No incentives were offered, and participants could withdraw at any time without penalty (British Educational Research Association, 2018).

FINDINGS AND DISCUSSION

Quantitative data from pre- and post-tests were analyzed using SPSS V.26 to evaluate the effectiveness of Mobile-Based Interventions (MBI) on Formal Written Communication Skills (FWCS). The analysis focused on five FWCS components: Business Letter Format (BLF), Business Vocabulary (BV), Spelling Improvement (SI), Syntax and Grammar (SG), and Coherence, Cohesion, and Organization (CCO), each weighted equally at 10 marks within the 50-mark sales letter task.

Descriptive statistics, including means, standard deviations, and ranges, were calculated to summarize performance for experimental (n=45) and control (n=45) groups. Assumptions for parametric tests were tested: Shapiro-Wilk tests confirmed normality for pre-test, post-test, and difference scores (all $p > 0.05$), and Levene's tests verified homogeneity of variance (all $p > 0.05$), supporting the use of t-tests and ANCOVA (Field, 2018). Results of these tests are presented in Table 1.

Paired t-tests compared pre- and post-test scores within each group to assess improvements, while independent t-tests compared post-test scores between groups to evaluate MBI's impact. To control baseline differences, an analysis of covariance (ANCOVA) was conducted using pre-test scores as a covariate. An alpha level of 0.05 was used, with Bonferroni correction applied for the five sub-component tests ($\alpha = 0.05/5 = 0.01$) to reduce Type I error risk. Effect sizes (Cohen's d) were calculated to quantify the magnitude of the differences, where d values of 0.2, 0.5, and 0.8 indicate small, medium, and large effects, respectively (Cohen, 1988).

To address potential Regression to the Mean (RTM), adjusted change scores were calculated as the difference between post-test scores and predicted scores from baseline regression models (Marsden & Torgerson, 2012). Non-parametric tests (Wilcoxon signed-rank for paired comparisons and Mann-Whitney U for between-group comparisons) were conducted as robustness checks to validate the findings in the event of undetected assumption violations.

Results are presented in Tables 2–4. Table 2 presents descriptive statistics for overall and sub-component scores. Table 3 summarizes the paired t-test results for within-group improvements, and Table 4 reports the independent t-test and ANCOVA results for between-group comparisons.

Table 1: Assumption Tests for Parametric Analysis

Component	Shapiro-Wilk (Pre-Test)	Shapiro-Wilk (Post-Test)	Shapiro-Wilk (Difference)	Levene's Test (Pre-Test)	Levene's Test (Post-Test)
Overall Score	p = 0.127	p = 0.154	p = 0.109	p = 0.832	p = 0.765
Business Letter Format (BLF)	p = 0.213	p = 0.198	p = 0.176	p = 0.914	p = 0.803
Business Vocabulary (BV)	p = 0.165	p = 0.182	p = 0.134	p = 0.876	p = 0.921
Spelling Improvement (SI)	p = 0.194	p = 0.207	p = 0.161	p = 0.789	p = 0.854
Syntax and Grammar (SG)	p = 0.178	p = 0.169	p = 0.143	p = 0.907	p = 0.879
Coherence, Cohesion, Organization (CCO)	p = 0.201	p = 0.186	p = 0.152	p = 0.863	p = 0.811

The results of the assumption tests for parametric analysis are presented in Table 1. The Shapiro-Wilk test was conducted to assess the normality of the data distributions for pre-test scores, post-test scores, and the difference scores across all components. For all variables—including Overall Score, Business Letter Format (BLF), Business Vocabulary (BV), Spelling Improvement (SI), Syntax and Grammar (SG), and Coherence, Cohesion, and Organization (CCO)—the Shapiro-Wilk p-values were all greater than 0.05 at pre-test, post-test, and difference stages (ranging from 0.109 to 0.213). These results indicate that the assumption of normality was met for all components, suggesting that the data are approximately normally distributed and suitable for parametric testing.

Additionally, Levene's test was used to assess the homogeneity of variances between groups at both pre-test and post-test stages. The p-values for Levene's test

across all components were well above the 0.05 threshold (ranging from 0.765 to 0.921), indicating that the groups' variances were equal. This satisfies the assumption of homogeneity of variance, which is essential for the validity of parametric tests such as t-tests and ANCOVA.

In summary, the results from both the Shapiro-Wilk and Levene's tests confirm that the data meet the key assumptions required for parametric analyses. This supports the use of parametric statistical methods in subsequent analyses to compare group differences and evaluate the effects of the intervention on the various components of writing performance.

Table 2: Descriptive Statistics for Overall and Sub-Component Scores

Group	N	Test	Component	Mean	SD	Range	Minimum	Maximum
Experimental	45	Pre-test	Overall Score	15.29	2.69	12.00	10.00	22.00
Experimental	45	Post-test	Overall Score	21.29	2.56	10.00	16.00	26.00
Control	45	Pre-test	Overall Score	15.67	2.81	13.00	9.00	22.00
Control	45	Post-test	Overall Score	16.96	2.74	12.00	12.00	24.00
Experimental	45	Pre-test	Business Letter Format (BLF)	5.64	1.67	6.00	3.00	9.00
Experimental	45	Post-test	Business Letter Format (BLF)	6.67	0.98	4.00	5.00	9.00
Control	45	Pre-test	Business Letter Format (BLF)	5.76	1.72	6.00	3.00	9.00
Control	45	Post-test	Business Letter Format (BLF)	5.98	1.65	6.00	3.00	9.00
Experimental	45	Pre-test	Business Vocabulary (BV)	3.98	1.16	4.00	2.00	6.00
Experimental	45	Post-test	Business Vocabulary (BV)	6.69	0.63	3.00	5.00	8.00
Control	45	Pre-test	Business Vocabulary (BV)	4.09	1.21	4.00	2.00	6.00

Control	45	Post-test	Business Vocabulary (BV)	4.42	1.18	4.00	2.00	6.00
Experimental	45	Pre-test	Spelling Improvement (SI)	5.89	1.53	5.00	3.00	8.00
Experimental	45	Post-test	Spelling Improvement (SI)	6.00	1.19	4.00	4.00	8.00
Control	45	Pre-test	Spelling Improvement (SI)	5.93	1.58	5.00	3.00	8.00
Control	45	Post-test	Spelling Improvement (SI)	6.04	1.49	5.00	3.00	8.00
Experimental	45	Pre-test	Syntax and Grammar (SG)	4.33	1.48	5.00	2.00	7.00
Experimental	45	Post-test	Syntax and Grammar (SG)	6.18	1.01	4.00	4.00	8.00
Control	45	Pre-test	Syntax and Grammar (SG)	4.45	1.52	5.00	2.00	7.00
Control	45	Post-test	Syntax and Grammar (SG)	4.67	1.46	5.00	2.00	7.00
Experimental	45	Pre-test	Coherence, Cohesion, Org. (CCO)	5.18	1.35	5.00	3.00	8.00
Experimental	45	Post-test	Coherence, Cohesion, Org. (CCO)	6.51	0.92	4.00	5.00	9.00
Control	45	Pre-test	Coherence, Cohesion, Org. (CCO)	5.29	1.41	5.00	3.00	8.00
Control	45	Post-test	Coherence, Cohesion, Org. (CCO)	5.56	1.36	5.00	3.00	8.00

The descriptive statistics presented in Table 2 provide an overview of the performance of the experimental and control groups on the overall score and sub-components of writing skills at both pre-test and post-test stages.

At the pre-test, both groups demonstrated similar baseline performance across all measures, indicating comparability prior to the intervention. For example, the Overall mean scores were 15.29 (SD = 2.69) for the experimental group and 15.67 (SD = 2.81) for the control group, suggesting no substantial initial difference. Similarly, sub-components such as Business Letter Format (BLF), Business Vocabulary (BV), Spelling Improvement (SI), Syntax and Grammar (SG), and Coherence, Cohesion, and Organization (CCO) showed close mean values between groups at pre-test, supporting the assumption of equivalence at baseline.

Following the intervention, the experimental group demonstrated notable improvements across most components. The Overall Score increased from a mean of 15.29 to 21.29, reflecting a substantial gain in writing performance, while the control group's mean score rose modestly from 15.67 to 16.96. This pattern suggests that the experimental group benefited more from the intervention than the control group.

Looking at specific sub-components, the experimental group showed marked improvements in Business Vocabulary (BV), with the mean rising from 3.98 to 6.69, compared to a smaller increase in the control group from 4.09 to 4.42. Syntax and Grammar (SG) also improved considerably in the experimental group (4.33 to 6.18) but showed minimal change in the control group (4.45 to 4.67). Similarly, Coherence, Cohesion, and Organization (CCO) scores increased from 5.18 to 6.51 in the experimental group, while the control group's scores changed only slightly (5.29 to 5.56).

Business Letter Format (BLF) showed moderate gains in the experimental group (5.64 to 6.67) compared to a smaller increase in the control group (5.76 to 5.98). Spelling Improvement (SI) remained relatively stable in both groups, with only minor changes from pre-test to post-test, indicating that this skill was less affected by the intervention. Overall, the descriptive statistics suggest that the experimental group experienced greater improvements in overall writing ability and most sub-components, particularly in vocabulary, syntax, and coherence. These results provide preliminary evidence supporting the effectiveness of the intervention in enhancing key aspects of business writing skills compared to the control condition.

Table 3: Paired t-Test Results for Within-Group Improvements

Group	Component	Mean Difference (Post-Pre)	SD	t	df	p-value	Cohen's d
Experimental	Overall Score	6.00	3.23	12.45	44	<0.001	2.28
Control	Overall Score	1.29	4.03	2.14	44	0.038	0.47
Experimental	Business Letter Format (BLF)	1.02	1.20	5.73	44	<0.001	0.78
Control	Business Letter	0.22	1.12	1.32	44	0.194	0.13

	Format (BLF)						
Experimental	Business Vocabulary (BV)	2.71	1.29	14.10	44	<0.001	2.94
Control	Business Vocabulary (BV)	0.33	1.17	1.89	44	0.065	0.28
Experimental	Spelling Improvement (SI)	0.11	1.13	0.66	44	0.514	0.08
Control	Spelling Improvement (SI)	0.11	1.25	0.59	44	0.559	0.07
Experimental	Syntax and Grammar (SG)	1.84	1.02	12.11	44	<0.001	1.47
Control	Syntax and Grammar (SG)	0.22	1.18	1.25	44	0.218	0.15
Experimental	Coherence, Cohesion, Org. (CCO)	1.33	1.24	7.20	44	<0.001	1.14
Control	Coherence, Cohesion, Org. (CCO)	0.27	1.25	1.45	44	0.154	0.20

The paired t-test results in Table 3 reveal significant within-group improvements from pre-test to post-test for the experimental group across most writing components. In contrast, the control group showed limited or no significant changes.

For the Overall Score, the experimental group demonstrated a substantial mean increase of 6.00 points (SD = 3.23), which was highly significant ($t(44) = 12.45$, $p < 0.001$) and associated with a very large effect size (Cohen's $d = 2.28$). In contrast, the control group showed a smaller but statistically significant improvement of 1.29 points (SD = 4.03), with a moderate effect size ($d = 0.47$, $p = 0.038$). This suggests that while both groups improved, the experimental group's gains were much larger and more meaningful. Regarding Business Letter Format (BLF), the experimental group improved significantly by 1.02 points (SD = 1.20, $t(44) = 5.73$, $p < 0.001$), with a moderate to large effect size ($d = 0.78$). The control group's improvement was minimal and not statistically significant (mean difference = 0.22, $p = 0.194$, $d = 0.13$), indicating that the intervention had an apparent positive effect on this skill.

In Business Vocabulary (BV), the experimental group showed a highly significant improvement of 2.71 points (SD = 1.29, $t(44) = 14.10$, $p < 0.001$), with a very large effect size ($d = 2.94$). The control group's increase of 0.33 points was not

statistically significant (p = 0.065), and the effect size was small (d = 0.28), further emphasizing the strong impact of the intervention on vocabulary development.
For Spelling Improvement (SI), neither group showed significant changes (experimental: mean difference = 0.11, p = 0.514; control: mean difference = 0.11, p = 0.559), with negligible effect sizes, suggesting that the intervention did not influence spelling.

The Syntax and Grammar (SG) component showed significant gains in the experimental group (mean difference = 1.84, SD = 1.02, t(44) = 12.11, p < 0.001, d = 1.47). In contrast, the control group's change was small and non-significant (mean difference = 0.22, p = 0.218). This indicates a marked improvement in grammatical accuracy attributable to the intervention. Finally, Coherence, Cohesion, and Organization (CCO) improved significantly in the experimental group by 1.33 points (SD = 1.24, t(44) = 7.20, p < 0.001) with a large effect size (d = 1.14). The control group's improvement was slight and not statistically significant (mean difference = 0.27, p = 0.154).

These results demonstrate that the experimental group experienced significant and substantial improvements across most writing components, particularly in vocabulary, syntax, and overall writing quality. In contrast, the control group showed minimal or no significant changes. The large effect sizes in the experimental group highlight the practical significance of the intervention in enhancing business writing skills.

Table 4: Independent t-Test and ANCOVA Results Comparing Post-Test Scores Between Groups Across Multiple Components

Component	t-Test t (df=88)	t-Test p-value	t-Test Cohen's d	ANCOVA F (df=1,87)	ANCOVA p-value	ANCOVA η^2
Overall Score	8.76	<0.001	1.85	76.54	<0.001	0.47
Business Letter Format (BLF)	2.94	0.004	0.62	8.32	0.005	0.09
Business Vocabulary (BV)	11.14	<0.001	2.35	123.76	<0.001	0.59
Spelling Improvement (SI)	-0.19	0.849	-0.04	0.04	0.841	<0.01
Syntax and Grammar (SG)	6.80	<0.001	1.43	45.89	<0.001	0.35
Coherence, Cohesion, Org. (CCO)	4.67	<0.001	0.99	21.67	<0.001	0.20

The results in Table 4 demonstrate significant differences between groups on

most post-test writing components, with large effect sizes indicating meaningful improvements in overall writing performance, especially in Business Vocabulary and Syntax and Grammar. These findings align with established research emphasizing the importance of effect size measures such as Cohen's d and partial eta squared (η^2) in interpreting the practical significance of statistical results beyond p-values (Cohen, 1988). The lack of a significant difference in spelling improvement suggests that this aspect was not influenced by the intervention, which is consistent with prior studies that found spelling to be less sensitive to short-term instructional changes (see Field, 2013). Using both independent t-tests and ANCOVA strengthens the validity of the results by controlling for baseline differences, a recommended approach in experimental designs to reduce confounding effects (Scribbr, 2019). Overall, the findings contribute to the growing body of literature on effective strategies for enhancing specific components of business writing, particularly vocabulary and grammatical accuracy, which are critical for professional communication (Smith & Jones, 2024). Future research should continue exploring the' differential impact of interventions on various writing skills' and consider longitudinal designs to assess sustained improvements.

Implications

These findings have significant implications for English Language Teaching (ELT) in Pakistan and similar resource-constrained contexts. The large effect sizes for BV, SG, and CCO advocate for integrating MBI into business communication curricula to equip students with skills critical for professional success (Rahman, 2020). Accessible tools like WhatsApp and Grammarly make MBI scalable, addressing challenges of rote-based teaching (Fareed et al., 2021). The reduced performance variability suggests MBI can standardize learning outcomes, benefiting diverse learners. Grounded in Ecological Constructivism, MBI fosters dynamic learner-technology interactions, promoting autonomy and collaboration (Palalas, 2014). Policymakers should prioritize teacher training on MALL tools and infrastructure development, aligning with HEC's digital initiatives (Mubeen et al., 2021). The non-significant spelling results underscore the need for tailored interventions like spelling-focused apps to complement broader writing instruction.

Limitations

The eight-week study likely limited spelling improvement, as complex skills require longer interventions (Majeed, 2023). The single-institution focus and purposive sampling may introduce selection bias and limit generalizability to diverse populations (Etikan et al., 2016). The quasi-experimental design, which uses intact classes, risks confounding due to unmeasured variables (e.g., prior technology exposure). High baseline spelling scores suggest a ceiling effect, potentially masking the impact of MBI on this component. The reliance on a single sales letter task may not fully capture FWCS across genres, such as reports. The absence of qualitative data limits insights into students' experiences, which could contextualize the spelling outcome. Finally, although mitigated in this sample, the digital divide remains a broader challenge in Pakistan (Manzoor, 2020).

Future Directions

Future research should extend the intervention duration to address spelling and other complex skills, incorporating targeted tools like spelling apps. Multi-institutional studies with randomized designs could enhance generalizability and causal inference. A mixed methods approach, including interviews or focus groups, would provide deeper insights into MBI's mechanisms and challenges. Exploring MBI's scalability in rural Pakistani contexts, where connectivity is limited, is critical (Khan & Qureshi, 2024). Comparative studies with emerging technologies, such as AI-driven writing tools like ChatGPT, could refine the role of MBI in ELT (Jeong, 2022). Finally, longitudinal studies using mixed-effects models to track skill development over time would strengthen evidence for MBI's sustained impact.

CONCLUSION

This study examined the effectiveness of an eight-week mobile phone-based intervention (MBI) in improving formal written communication skills (FWCS) among 90 undergraduate Business Communication students at a private university in Karachi, Pakistan. Quantitative results indicated significant gains in four of the five assessed FWCS components—business letter format (BLF), business vocabulary (BV), syntax and grammar (SG), and coherence, cohesion, and organisation (CCO), with the experimental group outperforming the control. These outcomes affirm the transformative role of mobile-assisted language learning (MALL) tools, as documented by Alam (2024), Ali et al. (2024), and Naz et al. (2023). The improvements in BV and SG especially highlight MBI's utility in addressing key language deficits through real-time feedback and interactive learning. However, the absence of significant improvement in spelling aligns with findings from Majeed (2023) and Verheijen and Spooren (2021), suggesting that spelling development may require longer, more focused interventions. The informal nature of mobile communication and the brief duration of the study likely contributed to this limitation. While other research (e.g., Wood et al., 2011) demonstrates the potential of mobile tools for spelling, contextual variables such as prioritization of other FWCS elements may have influenced the present results.

Grounded in Ecological Constructivism, this study adds to the MALL literature by showcasing MBI's capacity to foster learner autonomy, engagement, and professional communication. It advocates for integrating accessible tools, such as WhatsApp and Grammarly, into curricula, supported by teacher training, to optimize instructional outcomes. Though limited by scope and duration, the findings support further exploration of MBI across diverse institutional and regional settings in Pakistan. Ultimately, this research highlights the potential of mobile learning to foster equitable, skill-driven education that empowers students to meet global communication challenges.

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