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Unified Framework for Blended Learning System in Bangladesh

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Abstract

While the impact of transformed technology (i.e., blended learning) has been the subject of considerable academic debate, blended learning (BL) has yet to be thoroughly investigated in modern education systems. Therefore, this study aims to develop a unified BL adoption framework that may enhance the successful leverage of educational potential within educational systems in context of Bangladesh. To develop the comprehensive BL adoption framework, we first investigated the relevant literature on BL adoption. Given that this approach is in its infancy in Bangladesh, we considered the viewpoints of major stakeholders to develop a unifying BL adoption strategy. Consequently, we performed a qualitative analysis using a purposive sample approach. Data was collected using a semi-structured questionnaire using in-depth interview techniques and analyzed by thematic analysis technique. We used the NVivo 12 Plus software suite for analytical purposes.

This study illustrates the pivotal factors influencing the adoption of BL within the educational sphere and its benefits for both student and instructor effectiveness. The novelty of the proposed BL adoption framework is in the integration of literature investigation and stakeholders' feedback, effectively connecting theory and practice. This framework provides a context-specific, flexible, and evidence-based approach unlike typical frameworks.

Keywords: Blended learning; education systems; adoption framework; Bangladesh. Introduction

1 Introduction

Technological advancements are enhancing the capabilities of online teaching methods, a trend lately seen in education as billions of students and educators continue to engage with online programs during the COVID-19 epidemic (Mali & Lim, 2021; Nikolopoulou & Zacharis, 2023). This model combines the optimal features of both strategies to develop a more adaptable, customized, and compelling educational experience for learners. BL is progressively implemented in academic institutions and career advancement programs

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because of its adaptability to various learning styles and contexts (McCarthy & Palmer, 2023). Consequently, BL is recognized not merely as a short-term fix but as a viable strategy for education that can improve student engagement, motivation, and overall learning outcomes. The transition to BL has gained significant importance in recent years, surged by technological progress and evolving needs for education. Despite seeming widely recognized and relatively simple in theory, BL consistently demonstrates superior outcomes compared to exclusively online or entirely face-to-face learning (Buhl-Wiggers, Kjærgaard, & Munk, 2023).

In the past couple of years, the education sector in Bangladesh has witnessed significant expansion (Pecha, 2024; Shahriar et al., 2021; Shohel, Ashrafuzzaman, Mahmud, Azim, & Khan, 2023); however, it continues to face challenges, including resource limitations, unequal access to quality education, and the ongoing digital divide (Adamu & Hawamdeh, 2020; Ahmed, 2021). Moreover, the COVID-19 pandemic prompted a swift shift to online learning, yet numerous institutions faced challenges transitioning from conventional in-person teaching to digital settings. This underscores the necessity for a sustainable and well-organized education strategy that integrates face-to-face and online learning factors. Therefore, developing a unified framework for BL in Bangladesh is essential in ensuring uniformity, accessibility, and excellence in educational transfer.

Furthermore, the Bangladesh University Grants Commission (UGC) recommended the inclusion of BL in higher education to deal with new challenges and improve strategies for instruction in the academic sphere. The UGC has established a BL policy (Tofail Hossain, 2024) and urged higher education institutions to adopt it (The Financial Express, 2022); nonetheless, it has not yet offered unified guidelines or a framework for its execution and adoption. Consequently, there is a lack of research regarding the comprehensive adoption framework of BL in Bangladesh. Addressing these drawbacks might offer further assistance in developing a unified framework for BL in Bangladesh.

While numerous studies have explored the impact of BL (Bock et al., 2021; Kintu, Zhu, & Kagambe, 2017; Singh, Sharma, & Paliwal, 2021) on student outcomes and have discussed the challenges and offered solutions for effective execution (Brenya, 2024; Khalid & Al Sire, 2021; Mensah Minadzi & Segbenya, 2024; Rasheed, Kamsin, & Abdullah, 2020), there has yet to be a particular focus to develop a unified framework for blended learning in a developing nation such as Bangladesh. Hence, this study aims to develop a unified BL adoption framework that may enhance the successful leverage of educational potential within educational systems in Bangladesh.

In response to the research objective mentioned above, this study attempts to answer the following research questions

a) What would be the most effective BL adoption framework in Bangladesh?

b) What are the best practices and guidelines for implementing BL in educational institutions?

The structure of the paper is outlined as follows. The following section presents an examination of the current body of literature. The study design and methodology are detailed in Section 3. Section 4 outlines the results derived from the descriptive and thematic analysis of the identified literature. This section further elaborates on the suggested BL framework. Section 5 explores possible policy recommendations and future research avenues, while Section 6 represents the study's concluding observations. The structure of the paper has been described in graphical form in Figure 1.

2. Literature Review

2.1 Blended Learning

Among the most popular definitions of BL, two specific ones have been frequently cited in the literature. BL was defined by Graham (2006) as follows: "BL systems combine face-to-face instruction with computer-mediated instruction" (p.5). It can be said that the whole concept of BL revolves around the terms' face-to-face' and 'online'. BL is an amalgamation of these two methods of dissemination and absorption of knowledge.

However, Allen and Seaman (2010) defined BL slightly differently. A bit less influential: "Course that blends online and face-to-face delivery. A substantial proportion of the content is delivered online, typically uses online discussions, and typically has fewer face-to-face meetings" (p.5). In this definition, the author tried to draw a fine line between the extent of both learning mediums to be recognized as a blended form of education. According to the author, most lectures should be delivered online to be labeled as a blended form of learning. The number of face-to-face interactions shall be less than zero in comparison. Thus, all the definitions mentioned above of BL suggest that it is an innovative form of education made possible by both distant and in-person learning through technology.

2.2 BL in developing countries

BL environments integrating online and in-person learning have become increasingly popular in developing nations, particularly following the COVID-19 pandemic (Mali & Lim, 2021). Studies emphasize the method's benefits, such as increased flexibility, higher student engagement, and better learning outcomes. Many students prefer blended teaching and learning methods (Nikolopoulou, 2022). BL environments in developing countries face numerous challenges due to various factors. To begin with, the main obstacle is the lack of technological infrastructure, such as limited internet access and a shortage of digital devices for both students and teachers (Brenya, 2024). In many areas, unstable internet connections hinder learners from fully engaging with online materials and tools. Furthermore, inadequate training for educators in using digital teaching tools impedes the effective integration of BL approaches. Another major hurdle is the absence of institutional support, including professional development opportunities and incentives for teachers to adopt BL methods (Mensah Minadzi & Segbenya, 2024).

In addition, BL environments in developed countries have received much attention because of the leveraging of advanced technology to enhance the educational experience. Despite several obstacles, BL is also increasingly seen as a way to improve academic

outcomes. Prepare students for the rapidly evolving digital landscape and promote collaboration and critical thinking skills. Technology integration continues to transform the educational landscape. In developed countries, BL gives students of all ability levels the chance to progress at a speed that suits them. While struggling students can go at their own pace and receive specialized coaching when they get stuck, fast learners can advance more quickly.

2.3 BL in Bangladesh

Many universities in Bangladesh adopted the BL approach during the Covid-19 pandemic. Some universities, especially private universities, follow the BL approach following the pandemic. For example, universities conduct online classes through Zoom or Google Meet during a crisis to carry on uninterrupted academic activities. The students feel comfortable and sharpen their efficiency through successfully adopting the BL approach. BRAC University adopted the BL approach during the pandemic to carry on academic activities. BRACU developed BUX, an online learning platform, to facilitate all sorts of educational activities smoothly. Following the pandemic, BRACU adopted the BL approach for the convenience of the students. This approach is highly needed during the crisis period.

During the Covid-19 lockdown, educational institutions were ultimately forced to start operating virtually. However, after the lockdown, they have not given up on the idea. Nowadays, they are using both offline and online platforms for education. For example, besides BRACU has significantly adopted ZOOM, Google Meets, and Google Classroom as a part of the BL system, for many unavoidable reasons, traditional classroom teaching gets hampered in Bangladesh due to extreme political situations, extreme weather conditions, and many other external factors. Not only universities but many schools have embraced the BL system. For example, Roy, Das, and Afrose (n. a) surveyed 30 urban and rural secondary schools. These schools adopted the online learning system during the pandemic era. But the exciting thing is that they still practice the system alongside traditional classroom-based teaching methods. Ultimately, we can claim that BL is becoming established and popular in Bangladesh daily.

Schools have already started including ICT in the curriculum to implement computer labs, digital classrooms, and online materials, apart from Govt. schools, universities, and e-learning platforms, including BL in their area. The University Grants Commission (UGC) and several higher education institutions have played a vital role in promoting BL by utilizing online platforms, video lectures, and digital resources with in-person classes (The Financial Express, 2022). The movement toward BL achieved progress after the Bangladesh Open University (BOU) and a few other private universities began experimenting with e-learning tools.

Moreover, in compliance with the government's BL Model, the SAJIDA Foundation has successfully developed The SAJIDA Learning Center, which blends the online and offline platforms. To carry out innovative studies on the availability and demand for tech-based

after-school education, the foundation worked together with leading ed-tech Shikho. SAJIDA Learning Centre was set up in Comilla and Narsingdi with high-speed Internet to facilitate the live broadcasting of classes and ensure seamless access to the educational app for students. They supported their students by providing a tablet with internet connectivity for accessing the Learning Management System (LMS) (Rabbane & Qumqum, 2024).

Similarly, organizations like CholPori and platforms like Muktopaath have explored BL to enhance the communication of educational content throughout Bangladesh. CholPori, a digital learning platform, first started using BL to improve learning for Bangladeshi primary school kids. Later, they moved away from traditional education to develop critical thinking skills aligned with the national curriculum for math and English (Pecha, 2024).

2.4 Previous Model Used in BL

BL is also known as the hybrid approach to education, which can combine both traditional face-to-face and digital methods (Nikolopoulou, 2022). This approach to teaching has gained popularity in both academic and professional training environments. This type of learning offers flexibility and access to multiple data streams and content (Müller, Mildenberger, & Steingruber, 2023). Allowing the students to experience the process of absorbing information and skills and learning about subject matter more systematically enriches a student's education. It makes it less stressful to the students. This mixed approach to learning and teaching has increased in popularity after the pandemic. There are several models used previously for the effective implementation of BL. These models offer flexibility, personalized learning, and improved access to educational resources (Fake & Dabbagh, 2023). Based on the previous research, here are some of the most popular models described.

2.4.1 Flipped model

The flipped model is where traditional instruction is reversed among the various BL models. Learners engage with content, such as videos or readings, outside training sessions, leaving in-class time for active learning through discussions and activities (Suleiman, 2018). This model enhances engagement and personalizes the learning experience. Students first explore instructional materials online, such as videos or readings, outside the classroom. In-person sessions focus on interactive activities like discussions and practical applications, fostering more profound understanding. However, the main challenge of the flipped framework is to guarantee constant student engagement and equal access while also assisting educators in efficiently managing both online and in-class elements.

2.4.2 Project Based Model

This project-based model focuses on real-world tasks as instructors provide resources aligned with course concepts and teach these concepts in the practical setting. This model is designed to give focused guidance and address the learners specifically. Overseeing project-based activities, especially in large classrooms, may be challenging, hindering the provision of individualized feedback and assistance. At the same time, project-based learning requires extensive structure and effort, posing challenges for integration into constrained academic timetables, particularly when coupled with other instructional responsibilities.

2.4.3 A la carte model

The a la carte model offers flexibility, allowing learners to choose the time and mode of instruction, either in-person or online (Nass, Skuliabina, Kamalova, & Nass, 2021). This model benefits those with busy schedules, allowing them to learn at their own pace. Students may have difficulty scheduling and self-discipline when managing many online and in-person classes, resulting in uneven interest or performance. Students enroll in online courses independently of their traditional school curriculum. This approach offers more elective options, enabling learners to pursue interests or subjects not available in their primary institution (Nass et al., 2021). Instructors may need specialized training to create and administer online courses, yet not all instructors possess the requisite abilities or resources.

2.4.4 Flex Model

A Flex model of BL is used to cultivate digital citizenship as this model is used for teaching methods for non-traditional students and allows those students to work independently and learn to develop and create a working concept in the digital environment (Adamu & Hawamdeh, 2020). Students guide themselves through course content in an online environment with occasional academic support. Students guide themselves through course content in an online environment with occasional academic support. This model emphasizes flexibility, allowing learners to progress at their own pace while receiving targeted support when needed. development for educators to facilitate individualized learning proficiently.

2.5 Research Gap

The "Unified Framework for Blended Learning System in Bangladesh" literature study identifies several research gaps for further investigation. Despite the increasing interest in BL, there exists an absence of extensive research that addresses the unique demands of students from varying socio-economic situations, especially in rural regions. Recent literature primarily emphasizes urban settings, resulting in a gap in comprehension of the impact of infrastructural constraints, digital literacy, and technological access on the efficacy of blended learning in underdeveloped areas. Moreover, the Bangladesh University Grants Commission (UGC) encouraged using BL in higher education to address emerging challenges and enhance pedagogical approaches in higher education. The UGC has formulated a BL policy and encouraged higher education institutions to embrace it; however, it has not provided any guidelines or unified framework for its implementation and adoption. Hence, there is no research on the unified adoption framework of BL in Bangladesh. Rectifying such shortcomings might provide more evidence for developing a unified framework for BL in Bangladesh.

3. Methodology

Content analysis and expert interview-based technique was used for this investigation. Expert interviews and an analysis of existing literature have been utilized in information systems research to examine phenomena within their natural context. Expert interviews enable the researcher to explore and obtain profound and significant insights about the topic.

A vast amount of literature presents various end-user adoption models to demonstrate the most effective approaches for successfully transitioning from traditional face-to-face teaching to blended learning teaching settings. However, in most of the research, these investigations have been grounded in testing or validating theoretical frameworks (Antwi-Boampong & Bokolo, 2022). This is the degree to which the methodologies are often called into question. Due to a lack of sufficient theoretical investigations to formulate hypotheses, as identified in a literature review, an inductive Grounded Theory (GT) technique (Glaser, 2002) was chosen as the suitable technique for this study. Qualitative research methodologies, including content analysis, were used to comprehensively understand the educational phenomena and procedures affecting BL inside the institution.

This study posits that while studies about BL adoption have predominantly utilized deductive methodologies to formulate models such as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Hossain, Abdus Salam, & Rahman Akhond, 2024; Maisha & Shetu, 2023), there is a significant shift towards recognizing the value of integrity, embracing institutional-cultural learning paradigms, and emphasizing end-user-based appraisal. GT is crucial for establishing a BL adoption framework since it offers a systematic, deductive technique for constructing a theoretical framework rooted in empirical evidence (Dahwa, 2024). Instead of evaluating prior assumptions, GT enables researchers to construct theory straight from the facts. The GT method guarantees that the framework precisely reflects participants' actual experiences in BL In this study, it was decided to use a two-stage qualitative data collection and analysis technique; First, this study reviewed the most current literature and positioned the newly recognized factors found in existing publications and surveys about BL adoption experiences to enhance the emergent factors.

The first stage was identifying existing articles inside the Scopus database. The rationale for using the Scopus database lies in its status as one of the greatest repositories of peer-reviewed research papers, including a diverse array of fields, including science, technology, and social sciences. It covers many journals, conference proceedings, books, and patents, making it a thorough resource for acquiring pertinent academic materials. The objective was also not to utilize the conclusions derived from the analyzed data of the articles to evaluate the developing model or concept.

3.1 Literature Review Stage

This technique highlights the systematic strategy used for the literature review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Sarkis-Onofre, Catalá-López, Aromataris, & Lockwood, 2021) to conceptualize a BL model. The review conforms to recognized protocols and best practices for systematic reviews, guaranteeing transparency, reliability, and consistency in the filtering, analysis, and synthesis of relevant data.

3.1.1 Search Strategy

A clearly stated search strategy is essential for guaranteeing that the SLR is exhaustive, impartial, and reproducible. A full search of the relevant literature was carried out using Scopus , a recognized academic database, to guarantee that all relevant researches were included. The search used critical terms and their equivalents to cover the pertinent literature.

The search phrases have been combined and refined using boolean operators (AND, OR, NOT). This technique assisted in adjusting the search results according to their relevancy. This study applied the following search terms;

> *("blended learning" AND ("theoretical model" OR "hybrid teaching framework" OR "learning framework") AND ("technology" OR "e-learning" OR "online learning")).*

3.1.2 Inclusion, Exclusion Criteria, and Paper Extraction

The following search criteria were applied to refine the search outcomes and guarantee the inclusion of merely the most relevant research: research conducted between 2018 and 2024 aims to identify present-day trends and advancements in the BL framework. Articles and conference papers have been taken into account. Only articles published in the English language were included. Furthermore, empirical studies have been incorporated—whether qualitative, quantitative, or employing mixed methods—along with theoretical and conceptual frameworks. Focus solely on research articles, avoiding opinion pieces, newspaper articles, books, book chapters, case studies, editorials, and other non-research content. A series of checks will be performed on the search results: titles and abstracts have been used to check all publications for relevance. Articles irrelevant to blended learning or that did not fall under the review's parameters will not be considered. To determine whether the articles were eligible for inclusion, we read their whole texts once they passed the first screening. We did not include articles that do not pertain to the creation of BL models, provide insufficient information, or are of poor quality. The preliminary review concludes with the inclusion of 41 relevant papers for additional study.

3.2 Expert and end-user opinion phase

The second stage consisted of conducting interviews with end-users and experts of BL whom were policymakers, policy implementer, BL practitioners in the field of education. Although there are no universal "threshold" values (van Rijnsoever, 2017) of experts to engage in qualitative research, Marshall, Cardon, Poddar, and Fontenot (2013) suggest conducting 20-30 interviews that applied GT, contingent upon the study's objectives, scope, and approach. The respondents were selected using purposive sampling techniques (Rachmadtullah et al., 2020), focusing primarily on academicians who received training to teach in online teaching mode and students who used online learning during COVID-19.

Experts – Academic professionals, BL practitioners, BL policy makers, instructional designers, and e-learning technologists possessing expertise in the design and implementation of BL systems.

End-users - comprise university students and faculties who have had prior experience with BL platforms.

www.scopus.com

4. Results

4.1 Findings from existing Literature (based on thematic analysis)

Five overarching themes were established, pertaining to terminology, scenarios, drives, disclosures, and consequences of BL. The themes and subthemes are delineated and emphasized in boldface in the following stage. Theme names use the original wording of the posters wherever feasible.

4.1.1 Institutional factors

When it comes to the successful implementation of blended learning programs, having support from competent leadership is absolutely necessary (Ali, 2023). Committed senior leaders provide a substantial contribution to the improvement of an institution's preparedness to execute quality assurance activities, which is a concept that is equally applicable to blended learning (Fernandez-Chung, Jalonen, & Yee, 2024). Administrators and instructors have shown a willingness to implement blended learning; yet, they are confronted with problems owing to a lack of resources that are suitable. This highlights the significance of leadership in the process of allocating resources and providing institutional support for blended learning projects. Educators combine online tasks with live activities in a well-equipped setting, improving the overall educational experience (Roy & Abdin, 2023). As per the a2i missions, the government demonstrates the significance of digital education through programs like the BEFA framework, which integrates many learning modalities to enhance accessibility and efficacy in education. This strategy entails collaboration with NGOs and other organizations to bolster these efforts and to overhaul the educational system.

Blended learning practices are framed by several institutional factors in Bangladesh. The key factors are strong leadership support and sufficient infrastructure and resources in implementing blended learning. However, in reality, adoption of blended learning methods in the can help to combat the institutional challenges and actualize a sharp potential of improving educational quality and access.

4.1.2 Technology readiness

Blended education is thus an umbrella term referring to any of the education types that incorporate technology in any physical or online environments with synchronous and asynchronous interaction events possible, whether low tech or high tech or no tech. It is a means to introduce the best media or the best learning and teaching strategy or the best technology for creating an experience of flexible and meaningful learning conducive to better learning outcome. However, since this kind of teaching is in place, there is a need for physical presence of both the teacher and the student, virtual presence of the teacher and the student along with control of the student in time, place, path or pace.

Both the student and the educators digital literacy is required as only the proper usage of digital tools is not enough, they have to evaluate, create and communicate information on digital media (Obada et al., 2023). With rapid expansion of Internet access and the urgency of bringing young people up to date on the digital skill they need to negotiate the subtleties

of the digital world. Basic computer skills is something many people in the population, and most of all people living in rural areas where education resources are limited. In fact, more than 50% of school teachers answer that they teach in schools with insufficient technology (Chowdhury, 2020). During the time of the COVID 19 pandemic, there would be students who would have difficulty adapting to online learning because digital skills was necessary in order to be used in it. A study showed that many learners have hardly any experience in online presentations and collaborative tools and it is reflected in the participation of learners in blended learning activities (Hossain et al., 2024). Even the field could be leveled out for students from different backgrounds through the holding of subsidized internet initiatives, or even by giving away the devices.

4.1.3 Content and curriculum design

Moreover, Interactive components such as gamified activities, videos, and real-time assessments promote active participation, thereby enhancing engagement and facilitating knowledge retention (Dahri et al., 2024; Porkodi & Tabash, 2024). An intuitive learning management system serves as the fundamental framework, guaranteeing effortless access to educational resources, monitoring advancement, and promoting interaction between students and instructors. The concept of mobility significantly augments efficiency by facilitating learning in a flexible manner via mobile-friendly platforms and applications, thereby accommodating a variety of learner requirements and timetables (Dahri et al., 2024). To enhance the efficacy of implementation, it is imperative that curriculum design is meticulously aligned with the established learning objectives. Consistent feedback mechanisms and data analysis are essential, facilitating ongoing enhancements and tailored educational trajectories, thereby guaranteeing a cohesive and effective blended learning experience (Shakeel, Haolader, & Sultana, 2023).

4.1.4 Budget allocation

Effective budget allocation in blended learning involves the strategic distribution of resources to enhance educational impact and ensure sustainability (Antwi-Boampong & Bokolo, 2022). A central theme is the importance of prioritization, wherein funding is directed towards critical elements such as effective learning management systems (LMS), superior digital content, and dependable technological infrastructure. Investment in professional development for educators is of paramount importance (Antwı-boampong, 2021), as it ensures they are adequately prepared to deliver and manage blended learning with efficacy. Another theme pertains to mobile learning (Ali & Georgiou, 2024), wherein budgets are allocated with an eye towards future growth, encompassing the expansion of access to mobile learning and the enhancement of digital tools as requirements evolve. Moreover, the consideration of cost-effectiveness is paramount, as it reconciles initial expenditures with potential long-term savings, including diminished requirements for physical infrastructure. Consistent assessment and decisions informed by data guarantee that resources are allocated to areas of significant impact, including tools for learner engagement and tailored learning pathways (Ali & Georgiou, 2024; Hamad, Shehata, & Al Hosni, 2024). In conclusion, a meticulously crafted budget facilitates a sustainable, inclusive, and effective blended learning model.

4.1.5 Evaluation and continuous development

Assessing blended learning education necessitates a thorough examination of its efficacy in meeting educational objectives, as well as its potential for ongoing enhancement. Furthermore, conducting a benchmarking exercise against established objectives and comparable institutions guarantees adherence to exemplary standards. Ongoing development is facilitated by adaptive learning technologies that modify content in response to performance data, alongside iterative updates to the curriculum informed by evaluation outcomes, thereby nurturing a dynamic and effective learning environment (Teane, 2024; van der Stap, van den Bogaart, van Ginkel, Rahimi, & Versendaal, 2024).

4.2 Findings from the field study

4.2.1 Participants Demographic Information

Primary data illustrates the demographic profiles of 67 responders about BL. A majority of the participants are male (65.7%), and female respondents represent 34.3%. A notable 83.6% of participants are aged 18-30 years and the rest of the 15% of the respondents are distributed across older age groups, with little representation (1.5%) in the 51-60 years segment. The predominant group of responses consists of students (68.7%), followed by instructors (13.04%). Other professions include corporate workers, marketers, policymakers, project managers, and research assistants, with each category constituting 1.5% of the sample. 73.6% of the participants possess fewer than 3 years of experience in BL, categorized as follows: fewer than 1 year (40.3%), 1 to 3 years (34.3%), whereas just 11.9% have more than 4 years of experience, indicating that the use of BL is relatively nascent and expanding. The predominant proportion of respondents is affiliated with university (79.1%), whilst 16.4% are associated with government institutions. Non-profit organizations (3.0%) and educational technology firms (1.5%) constitute a minor fraction. The majority of respondents are either seeking or have attained a Bachelor degree (58.2%), while Master degree holders constitute 40.3%. Merely 1.5% own a PhD.

4.2.2 Findings from primary data (end-user and expert interview)

4.2.2.1 Word Cloud Analysis

This word cloud has been produced from textual data, illustrating the most commonly occurring terms within a dataset pertaining to blended learning in Bangladesh. The greater the size of the word, the more often it is encountered within the dataset, thereby signifying its significance in discourse.

Core Theme - The most significant terms include “learning,” “digital,” “students,” “infrastructure,” “support,” and “resources,” indicating that the subject matter mostly centers on the ongoing development of digital learning systems for pupils. Moreover, “Blended,” “technology,” and “training” are also crucial, underscoring the importance of hybrid educational approaches that combine online and offline learning

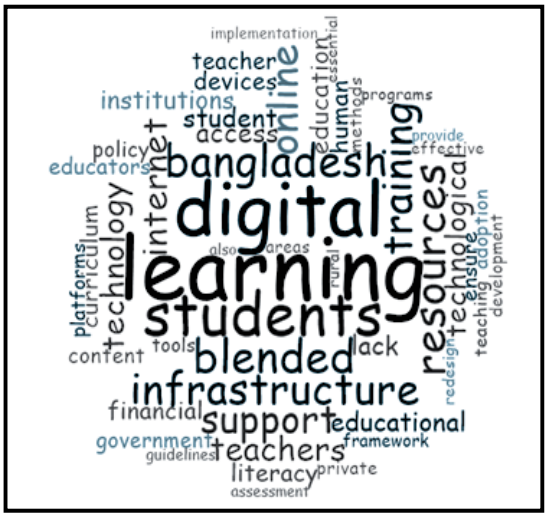

Figure 3: Word cloud analysis

Challenges Highlighted - The terms "infrastructure," "financial," "access," and "internet" indicate issues related to the accessibility of technology and internet connection necessary for efficient blended learning. The terms "support" and "government" suggest arguments over the contribution of policymakers in tackling these issues. The terms "teachers," "educators," and "training" signify an emphasis on teacher development and digital literacy.

Technological Adoption & Curriculum Development - Terminology such as "platforms," "tools," "content," "curriculum," and "assessment" signifies argumentation around the need for organized digital learning frameworks. The terms "policy" and "guidelines" indicate that regulatory frameworks and systematic execution are essential for an effective BL paradigm.

4.2.2.2 Contributing BL Factors and Discussions

This section highlights a range of contributing factors, or themes, alongside their corresponding sub-themes relevant to a particular context, undoubtedly BL, derived from responses obtained from different groups of people. Each theme indicates a comprehensive category of factors that put forth influence on the topic, whereas the sub-themes offer more precise details. The findings further explores the respondents who offered these responses, classified according to their respective roles or experiences.

Furthermore, the motivation of students in their learning efforts, as well as the engagement of students, faculty, the community, and other relevant stakeholders, is of paramount importance. Access to digital resources is essential for It is imperative to guarantee that students are provided with the essential tools required for their educational goals. However, it is imperative that learning preferences be adapted to various learning styles. As evidence:

"The implementation of student mentors produces two effects: enhanced motivation together with better student engagement."

"Shifting from rote memorization to interactive, student-centered learning can enhance engagement and understanding."

"Students together with teachers often show a preference for mental passivity because they favor didactic instruction instead of participatory approaches."

The information presented above offers a thorough examination of the various factors that impact the topic, alongside the stakeholders who have provided these valuable insights. This instrument may serve to pinpoint areas necessitating enhancement or concentration within the realms of policy formulation, resource distribution, or programs advancement.

4.2.2.3 Barriers of BL and Discussions

Furthermore, the deficiency in training regarding digital tools (R=4) and the nonexistence of national training programs (R=1) present significant obstacles to the adoption of blended learning. Educators also exhibit a deficiency in sufficient training (R=4). Evidence indicates that:

"There is a gap of student- teacher training (how to deal with online classes) requirement can be fulfilled." (UNICEF funded consultant, Graduate and post graduate students, manager (software developer), policy makers).

"Unified policy from government as well as teachers training should be adopted to ensure that public education sector encourages BL adoption in the classroom activities." (Project Manager in an ed-tech company).

At the same time, the challenge of implementing various evaluation methodologies while maintaining a consistent online assessment framework significantly influences both students and educators as well. As evident:

"Assessments should adopt project-based learning combined with digital portfolios and interactive assignments as evaluation methods to maximize the benefits of BL."

"Teachers should combine different evaluation techniques such as group projects and online discussions and project assessments."

In the end the considerable expense associated with digital devices (R=7) represents a significant obstacle, delivering blended learning less feasible, particularly for both students and educators. As per a student and BL petitioner:

"Limited resources, including the high cost of devices and lack of funding, can be hinder of BL adoption. NGO collaborations, and private-sector involvement in subsidizing digital tools may increase BL adoption."

4.2.2.4 Stakeholders Opinion for Successful BL adoption

This section presents a summary of qualitative data regarding opinions on the successful adoption of BL, systematically arranged by themes, sub-themes, response frequencies, and the various stakeholder groups involved.

The increasing importance of cultural adaptation (R=24) underscores the necessity of aligning BL with the regional cultural standards. Regional factors, with an importance (R=2), alongside socio-economic factors, which hold a relevance (R=1), are also underscored. It is imperative that BL puts an emphasis on cultural relevance rather than resorting to generic solutions. According to UNICEF-funded consultants, graduate & postgraduate students, ed-tech project managers, administrators of BL:

"……. if Bangla and English both is provided to navigate in the system, big number of students from rural area can participate."

"Empower divisional education boards to monitor progress and fast-track approvals."

In conclusion, in order to encourage participation, BL need to provide either monetary or cognitive benefits. To promote participation in Blended Learning (BL), the offering of both monetary and cognitive incentives is of paramount importance. Monetary incentives may encompass stipends, scholarships, or financial aid, whereas non-monetary rewards can consist of certificates, recognition, or techniques for gamification such as leaderboards and badges. The offering of such incentives serves to motivate both students and educators, thereby fostering increased participation and commitment within the academic environment.

4.3 Proposed Technical Solutions Framework of BL Adoption

The BL adoption paradigm presented in Figure 5 illustrate a viable plan for incorporating digital education into Bangladesh's upper secondary education system through collaborative content creation, low-cost infrastructure, and performance-based evaluation. The educational regulating authority may get started by building infrastructure solutions, such as using government-centralized server systems or third-party platforms like YouTube to host digital content. Teachers and students can use these materials, which should be assessed for quality using attributes such as simplicity of learning, engagement, clarity, and explainability. Low-cost technology solutions, such as mobile applications or offline learning tools, can help assure accessibility in resource-constrained environments. The framework focuses on non-monetary incentives, such as rewards and recognition, to inspire instructors. In order to ensure affordability, the government might work with telecom firms to offer free or subsidized internet connection through Corporate Social Responsibility (CSR) programs. Students from hard-to-

reach areas or remote areas can be reached using offline alternatives such as SD cards, USB devices, or low-bandwidth programs (for example, MuktoPaath). Practical initiatives include establishing instructor evaluation systems that collect input from students, instructors, and administrators, as well as creating training programs for educators to improve their digital teaching abilities. By emphasizing cost, quality evaluation, and stakeholder participation, the framework may successfully promote blended learning throughout Bangladesh.

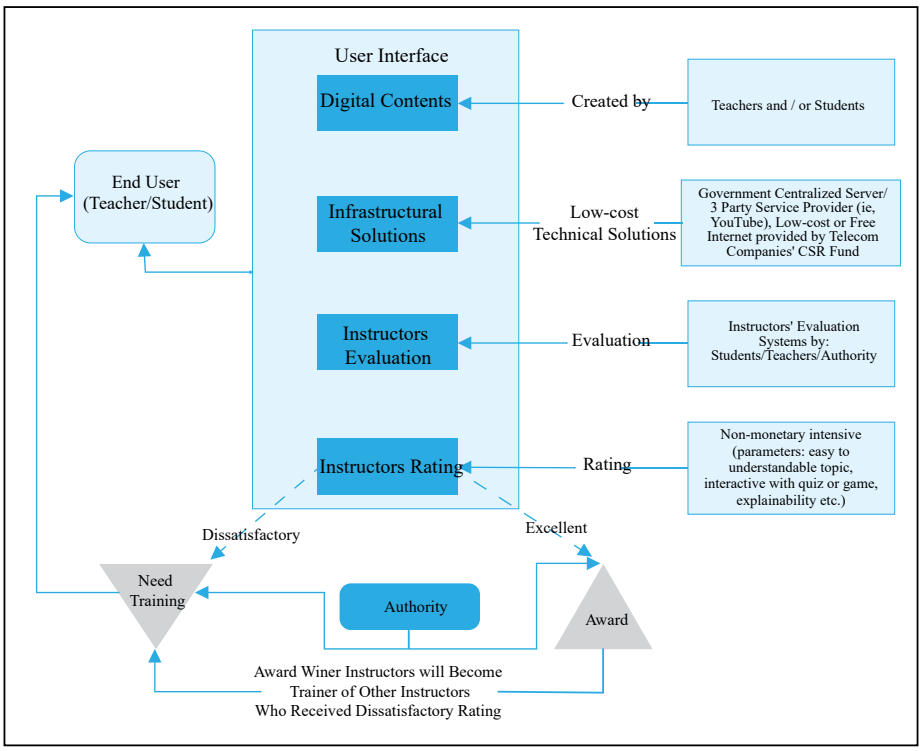

Figure 5: Proposed Cost-effective Technical Solutions Framework of BL Adoption

Bangladesh may successfully integrate BL by creating centralized digital repositories, low-cost internet solutions, teacher evaluations, and non-monetary incentives. The key is government leadership, stakeholder engagement, and constant feedback-driven changes to assure access and excellent education for everyone.

5. Theoretical Contributions

This study offers a significant theoretical contribution to the debate regarding the adoption of BL by proposing a framework that integrates insights from academic literature alongside the involvement of end-users, thus addressing a crucial gap in current models. Conventional frameworks frequently emphasize either overarching theoretical constructs derived from a top-down approach or empirical data gathered from a bottom-up perspective, leading to a division that constrains their practical applicability. Through the integration

of these dual standpoints, our framework enhances a more comprehensive understanding of BL adoption, successfully confronting the interplay among institutional, pedagogical, and technological dimensions, whilst firmly support theory in the realities experienced by practitioners and learners.

Finally, through the application of participatory action research, this study offers a methodological framework for the advancement of theory in the realm of learning technology. The involvement of end-users has ensured that the constructs of the framework extend beyond mere abstraction, thereby promoting a theory that has solid foundations in practical application. This approach raises issues with conventional positivist methodologies, promoting the idea of co-constructed insight that enriches translational research—effectively addressing the "knowing-doing" gap in the application of BL.

6. Conclusion and Limitations

A revolutionary potential to increase education availability, quality, and resilience in Bangladesh is presented by the BL. By tackling fundamental challenges and utilizing strategic facilitators, the Education Regulatory Body might accelerate the implementation of BL in Bangladesh. This necessitates a well-coordinated policy action, resilient infrastructure, empowered educators, and sustainable funding blueprints. The conceptual model functions as a pivotal instrument to facilitate behavioral shifts and systemic reform within the education sector in Bangladesh.

The conceptual model for BL adoption illustrates a dynamic interaction of challenges, underlying motivating factors, and solutions gathered from both primary data and existing literature. There are significant institutional, infrastructural, and pedagogical challenges that prevent broad adoption. Some examples of these barriers include inadequate financing, a lack of training, and conventional teaching approaches. In addition to these, behavioral elements like as motivation and desire to utilize BL systems, which impact actual implementation, combine to make the situation even more complicated.

The framework emphasizes the significance of principles that are relevant to the setting, such as flexible infrastructure, diverse financing, and the empowerment of instructors via initiatives such as education e-communities and AI-driven chatbots. Moderating factors, such as incentives (whether monetary or non-monetary), further affect adoption by matching the motives of stakeholders with the primary objectives of the organization.

The proposed BL adoption solutions, which include mediation and facilitation, have the ultimate goal of bridging the gap between the issues and the tactics that can be implemented. Institutions have the ability to support sustainable adoption of BL by addressing structural hurdles, using behavioral insights, and being technologically ready. This will ensure that learning environments are fair and effective. In the future, efforts must emphasize policy consistency and consistent reformation, constant review, and collaborative partnerships in order to fully achieve the promise of blended learning.

Of the utmost importance, however, this research is not without its limits. The framework has been developed in accordance with particular themes identified in the literature review and primary data, specifically through in-depth interviews. However, it is important to note that this approach may not adequately encompass the varied contexts present within all educational institutions, such as those pertaining to primary education. The findings may not be relevant in contexts characterized by substantially distinct infrastructural, institutional, or cultural (i.e., indigenous school context) conditions. Furthermore, although initiatives such as "Diversity funding," "AI-powered chatbots," and "Education e-community" have been suggested, the framework malfunctions to tackle the enduring challenges of sustainability, including the maintenance of funding sources and the assurance of equitable access to technology in the long term.

Declaration of Competing Interests:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Ethical Approval

This research utilizes the secondary sources of published articles and only human opinion (perceptions) instead of biological facts and animal participants, such as in laboratory experiments, and is frequently exempt from ethical approval. However, this study followed all ethical codes of National Academy for Educational Management (NAEM), Dhaka, Bangladesh, and approved the study protocol before approving the funds. To eliminate any possible ethical issues, respondents' verbal and written concerns have been confirmed before the interview.

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Appendix A: Questionnaire of Study

Questionnaire of Study on "Unified Framework for Blended Learning System in Bangladesh"

Statement of Purpose & Consent:

Dear Respondent

This is ……. currently working as a data collector for the above-mentioned project supervised by Dr. Najmul Hasan, Assistant Professor in Information Systems, from BRAC Business School, BRAC University Dhaka Bangladesh funded by National Academy for Educational Management (NAEM), Dhaka. I am going to conduct a Focus group discussion/ in-depth interview on ***"Unified Framework for Blended Learning System in Bangladesh"*** in Bangladesh. This study aims to develop a unified BL adoption framework that may enhance the successful leverage of educational potential within educational systems in Bangladesh.

I have some inquiries for you. This information is important for improving blended learning education in Bangladesh. Please be assured that all information you submit will be only utilized for this study. **I am not intended to have your personal identity, and your information will be treated with confidentiality.** It is your desire to voluntarily participate in this study. You may even terminate the interview midway if you do not however feel comfortable. **I can assure you that this information will remain highly confidential.** If you would like to participate by giving your interview, we hope that you would provide us with genuine opinion. **The successful implementation of our research is dependent on the quality of the information you provide us.** Please feel free to ask any questions you may have about the research. Your inquiries will be answered to your satisfaction by me directly via e-mail – najmul.hasan@bracu.ac.bd as well (if you have).

Will you please allow me to proceed? (Check the appropriate box with✓)

Yes ☐ **No** ☐

Part A: Demographic Information (For Participants' Background)

Questions	Responses	Code
Age		……..
Gender	Male	1
	Female	2
Occupation/Role in Education	Teacher	1
	Administrator	2
	Student	3
	Policy Maker	4
	Blended learning practitioner	5
	Other (specify)	6
Years of Experience	Less than 1 year	1
	1-3 years	2
	4-6 years	3
	7+ years	4
Institution Type	Government	1
	Private	2
	Non-profit	3
	Other (specify)	4
Educational Level (of institution)	Bachalor	1
	Master	2
	PhD	3
	Post-doc	4
	Other (specify)	5

Part B: Understanding of Blended Learning (BL)

1. **How do you define Blended Learning (BL)?**
   - Follow-up: Can you provide examples of how BL is currently being used in your institution?
2. **What are the key components you believe should be included in a BL framework?**
   - Probe: Technology integration, face-to-face interaction, student-centered learning, flexible schedules, etc.
3. **What are the challenges you perceive when it comes to adopting BL in the Bangladeshi context?**
   - Follow-up: How do you think these challenges could be addressed?

Part C: Opinion on BL Adoption Framework for Bangladesh

1. **What factors do you think should be prioritized when developing a BL adoption framework in Bangladesh?**
   - Probe: Technology infrastructure, teacher training, cultural considerations, curriculum redesign, policy support, etc.

2. **What are the key barriers to adopting BL in Bangladesh, and how can these barriers be overcome?**
    - Probe: Infrastructure, digital literacy, resistance to change, lack of resources, etc.
3. **In your opinion, what resources (human, technological, financial) are needed to successfully adopt BL in Bangladesh?**

Part D: Opinion on Best Practices and Guidelines for Implementing BL in Educational Institutions

1. **From your experience or knowledge, what are some best practices for implementing BL effectively in educational institutions?**
    - Probe: Technology integration, collaborative tools, blended learning models (e.g., rotation, flipped classroom, etc.)
2. **What guidelines do you think are essential for institutions when they are transitioning to or scaling BL?**
    - Probe: Training teachers, selecting appropriate technology, creating an effective learning management system, measuring student performance, etc.
3. **What support mechanisms should be put in place for both students and teachers during BL implementation?**
    - Probe: Ongoing training, technical support, access to resources, etc.

Final Thoughts

1) What advice would you give to policymakers or educational leaders looking to adopt or scale BL in Bangladesh?
2) What additional comments or insights would you like to share regarding the adoption and implementation of BL in Bangladesh?