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Bridging the Digital Divide: Equity and Access Challenges in Blended Learning at the Tertiary Level in Bangladesh

Sadia Sultana[1*]

[1*]Assistant Professor Department of English Khan Bahadur Ahsanullah University Khulna, Bangladesh.

*** Correspondence:** Sadia Sultana

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ABSTRACT: Blended learning has revolutionized the way teaching in tertiary education is done in all parts of the world, not an exception in Bangladesh. Nonetheless, the effective execution of blended learning is still highly influenced by the digital divide, specifically in regard to access, equity, and engagement. This paper looks into the technological obstacles of university students in Bangladesh, the rural-urban gap, the influence of socioeconomic background on participation, and policy suggestions to develop inclusive blended learning. Under the Digital Divide Theory, the research will take a mixed approach using quantitative data of 100 students in both public and private universities and qualitative data via semi-structured interviews. Statistical examination using SPSS and thematic analysis show that disparities in access to the internet and devices, inadequate digital literacy, and financial limitations have a major impact on continuity of learning for students. The results also show disproportionate disadvantage of rural students as opposed to their urban counterparts. The paper holds that blended learning in the absence of institutional and national interventions can enhance educational disparities. Lastly, the article suggests a framework of sustainable blended learning that is equity-based in the tertiary sector of Bangladesh.

Keywords: *Blended Learning, Digital Divide, Higher Education, Learner Autonomy, Pedagogy*

1. Introduction

The high rate at which digital technologies are being adopted in higher education has radically changed the modern teaching and learning practices in the world. Blended learning (a combination of conventional face-to-face instruction, online learning, and technology-mediated learning activities) has in recent years become one of the most effective models of pedagogy that enhances flexibility, learner autonomy, and academic engagement (Garrison and Kanuka, 2004; Graham, 2006). The model has gained some special relevance in the educational contexts of the

developing world, where institutions are trying to strike a balance between pedagogical innovation and accessibility. Blended learning has become a popular concept in tertiary institutions in Bangladesh as an extension of the overall digitalization of higher education, especially in the wake of the post-pandemic transition to technology-enhanced learning spaces. Recent research in the Bangladeshi context indicates that blended learning can be significantly effective to enhance student engagement, digital literacy, employability skills, and academic continuity at the university level (Islam et al., 2025).

Although these pedagogical opportunities exist, the shift towards blended learning has also revealed a significant digital divide in terms of access, equity, and participation. The digital divide goes beyond internet access to encompass the differences in device, network stability, digital skills, and the proficient use of online learning systems (van Dijk, 2020). Structural socioeconomic inequalities, rural-urban infrastructural inequalities, and institutional support systems in Bangladesh are some of the factors that exacerbate these inequalities. According to the current studies, a great number of university students, particularly rural and low-income students, are still experiencing high levels of barriers, including unstable internet access, the absence of their own laptops, and poor digital literacy, as well as the inability to access learning management systems (Aziz and Hossain, 2024).

The problem statement is based on the reality that although blended learning is

traditionally touted as an inclusive and new model, disparities in digital access can actually reproduce or even exacerbate existing disparities in education in the tertiary sector of Bangladesh. The less fortunate students, with low socioeconomic status, will be less likely to attend all sessions of the synchronous classes, finish online tests, and have equal access to online learning materials. This gap is also exacerbated by the rural-urban divide, where students in less central areas have often poor broadband access and more expensive data plans, making it difficult to continue blended courses (Aziz and Hossain, 2024). The future of blended learning is therefore not well spread, and therefore, there is a growing concern of educational justice, social inclusion, and equity in higher education.

This study is thus three times important. To begin with, it adds to the expanding body of digital inequality research in the field of higher education by addressing the situation in

Bangladesh's tertiary education specifically, as there is not much research in the area on blended learning equity. Second, it offers evidence on the influence of technological, geographic, and socioeconomic factors on students' participation and persistence in blended learning settings. Third, the research provides policy-based recommendations to universities, the University Grants Commission (UGC), and stakeholders at the national level of education to develop more engaging, equal, and sustainable blended learning systems. Through these, the study aims to contribute to the overall objective of Bangladesh, which is to achieve equitable digital transformation in higher education and to help make blended learning a tool of inclusion, as opposed to exclusion.

2. Objective

This research aimed at understanding the effects of the digital divide on equity, access, and participation in blended learning by tertiary students in Bangladesh.

3. Literature Review

The so-called blended learning, or the purposeful combination of face-to-face learning with the online and technology-mediated learning setting, has become a revolutionary approach to pedagogy in higher education. It is commonly known all

over the world as a way of fostering flexibility, learner autonomy, and enhanced student engagement (Garrison and Kanuka, 2004; Graham, 2006). The studies also indicate that blended learning contributes to the improved interaction between learners and educators and promotes more profound thinking in case it is properly designed (Means et al., 2013; Hrastinski, 2019).

Empirical literature also demonstrates that academic performance and satisfaction of learners can be better with blended learning provided that the necessary technological infrastructure is present (Bernard et al., 2014; Halverson et al., 2015). Also, Osguthorpe and Graham (2003) note that blended learning enables the institutions to balance the advantages of a traditional learning environment with the flexibility of an online learning environment. It is becoming a popular way of increasing access to higher education in developing countries, preserving quality of instruction (Alammary et al., 2014).

With the Covid-19 pandemic making universities switch to online and hybrid education, blended learning gained significant traction in Bangladesh in the aftermath of the pandemic. Research has shown that blended learning increases student participation, communication ability, and digital literacy in the tertiary institutions in Bangladesh (Islam et al., 2025; Rahman and Sultana, 2023). Nevertheless, scientists like Kabir and Hasan (2022) and Chowdhury et al. (2021) claim that such advantages are not evenly spread because of the infrastructural constraints and the lack of digital preparedness among students.

The digital divide has changed in a number of ways. Initial conceptualizations oriented more towards access to computers and the internet, but today, digital inequality can be viewed in a multidimensional way that van Dijk (2020) defines as the access divide (access to devices and access to the internet), the skills divide (digital literacy and digital skills), and the outcome divide (differences in the benefits of using computers and the internet).

On the same note, Helsper (2021) states that digital inequality is not defined by access but also social, economic, and cultural capital, which define the effectiveness of individuals to utilize digital technologies. Warschauer (2004) further adds that meaningful access not only involves technological access but also the capacity to

utilize it in education.

Within the context of Bangladesh, several sources emphasize that although there is a relatively high level of mobile phone ownership among university students, there is still a lack of meaningful access to them because of the lack of stable internet connectivity, high prices of data, and poor digital infrastructure in institutions (Aziz and Hossain, 2024; Islam and Sarker, 2022). Additionally, Rahman et al. (2023) discovered that low digital literacy of students greatly limits their usage and interaction with the learning management systems, diminishing the effectiveness of blended learning environments.

There is substantial literature that underscores the rural/urban disparities as an important factor in digital access to higher education. In Bangladesh, urban students enjoy a relatively stable broadband connection and institutional access to digital devices, and rural students are likely to use mobile data with not always good network coverage (Hossain et al., 2022; Karim and Rahman, 2021). These structural disparities have a direct impact on enrollment in synchronous classes, assignments, and using online learning platforms.

These disparities are also enhanced by the socioeconomic status. Children with lower income are also less likely to have a personal laptop or tablet and use it and tend to share devices within their family, restricting their participation in blended learning activities (Aziz and Hossain, 2024). A study conducted by Sultana and Begum (2023) also indicates that financial limitations are another factor that limits students' ability to afford the internet packages and, hence, leads to inconsistent attendance during online courses.

Also, as Alam and Hossain (2021) point out, gender and geographic location overlap with socioeconomic aspects, which even expands the digital divide. These structural inequities underscore the fact that access to blended learning is not only a technological problem but also an even more general social equity issue.

Despite the presence of literature on the topic of blended learning and digital inequality, there are still a number of gaps. Pedagogical efficiency or technological access is studied independently in most studies, and the analysis of equity-based studies remains limited regarding the integration of digital disparities as a link

between digital disparities and learning results (Halverson et al., 2015; Islam et al., 2025). Access combined with digital literacy and academic performance has not been thoroughly empirically studied in Bangladesh. Moreover, although the presence of rural-urban and socioeconomic inequalities is well-established, the direct effect of these two factors on student engagement and retention at the micro level has a limited number of studies (Karim and Rahman, 2021; Rahman et al., 2023). In addition, not many studies employ mixed-method designs to describe the statistical tendencies and lived student experiences, which yields a research gap.

4. Theoretical Framework

The proposed work is based on the digital divide theory that describes how the disparity in the access to technological resources replicates the wider social disparities. This theory especially applies to blended learning since the learning process is more and more subjected to digital connectivity, technological competence, and institutional support. The framework aids in explaining the way inequalities in infrastructures and income and geographical location generate differentiated learning opportunities among tertiary students in Bangladesh.

5. Methodology

The research design used in this study is a mixed-method research design to examine the issues of equity and access in blended learning at the tertiary level in Bangladesh by combining both quantitative and qualitative research to provide a holistic view of the digital divide in higher education. The convergent parallel design was used, and quantitative and qualitative data were collected and analyzed separately and then combined to interpret it, to guarantee triangulation and make the finding valid and reliable. The research was conducted on 100 university students (both public and private universities) in Bangladesh who were chosen using stratified random sampling to represent the rural-urban areas, gender, and socioeconomic status. This methodology facilitated the acquisition of a variety of experiences regarding digital access and participation in blended learning. Various instruments were used to gather data, such as a structured questionnaire that focused on digital access, digital literacy, and blended learning participation; a digital access scale; and a blended learning participation scale based on the existing digital divide models. Moreover, a

set of semi-structured interviews with some students was organized to obtain the detailed information about the lived experience of these students in terms of internet connectivity, availability of devices, and learning problems. The surveys were conducted online and via face-to-face meetings (with the option of using online sources like Zoom and Messenger) depending on the availability of the participants, whereas the interviews took a considerable amount of time (20-30 minutes each), and ethical aspects, including informed consent and confidentiality, were strictly observed. The SPSS was used to analyze the quantitative data; descriptive statistics, independent sample t-tests, ANOVA, and regression analysis were performed to determine the relationship between the variables of digital access and blended learning participation. The thematic analysis was used to analyze the qualitative data to derive common themes about access barriers, socioeconomic barriers, and rural-urban differences. A combination of the two datasets gave a solid and more detailed insight into how digital inequality influences the effects of blended learning in tertiary education in Bangladesh.

6. Findings

The results of this research, based on quantitative data analysis using SPSS and the qualitative data obtained through interviewing, indicate that there is a substantial gap in access and participation of students in blended learning at the tertiary level in Bangladesh. The results are discussed based on descriptive statistics, cross-tabulation, t-test, ANOVA, and regression analysis, and then, qualitative interpretations are made to understand the results further.

6.1 Technological Barriers and Learning Participation

Table 1: Descriptive Statistics of Technological Barriers (n = 100)

Variable	Frequency (n)	Percentage (%)
Unstable internet connection	68	68%
Lack of personal laptop/device	54	54%
Difficulty accessing LMS	61	61%

According to the descriptive findings presented by Table 1, technological constraints are very common among the respondents. Most students (68) reported poor internet connectivity, and 54% of students had no personal access to devices like laptops. Moreover, 61% had challenges with client access to learning management systems (LMS).

Regression analysis was done to determine predictors of blended learning participation.

Table 2: Regression Analysis Predicting Blended Learning Participation

Predictor	β	t-value	Significance (p)
Internet stability	0.41	4.32	< 0.01
Device ownership	0.36	3.89	< 0.01

Model Summary: $R^2 = 0.47$, $F = 18.62$, $p < 0.001$

The regression model (Table 2) indicates that the factors of digital infrastructure contribute to 47% of the variability in the participation in blended learning. The level of internet stability and device ownership are both statistically significant predictors ($p < 0.01$), as they prove that students who have improved digital access will have higher levels of participation.

These findings are supported by qualitative information. Learners have reported having numerous distractions in live classes and being unable to submit their work on time. One of the students said, "I lose concentration in lectures, and I am not able to engage in the discussion." This underscores the fact that technological barriers are non-incidental.

6.2 Rural–Urban Disparities in Digital Access

Table 3: Independent Sample t-test (Rural vs Urban Students)

Group	Mean Internet Access Score	SD	t-value	p-value
Urban	3.82	0.76		
Rural	2.91	0.88	4.28	< 0.05

Table 3 indicates that there is statistically significant difference between rural and urban students. The urban students showed a high internet access and stability (M = 3.82) than the rural students (M = 2.91) and a clear geographical digital divide exists.

Table 4: ANOVA Results for Participation by Location

Source of Variation	F-value	Significance
Location	6.54	< 0.01

The results of the ANOVA (Table 4) validate that there was a great difference in participation according to the geographical location. Rural students were always less likely to attend synchronous classes and participate in online learning activities.

The reasons behind these statistical differences are described in qualitative findings. Rural students complained about poor networks and frequent power interruptions as well as expensive internet charges. One of the participants said, "In case of network failure, I miss a whole course of classes, and I could not catch up." This shows that location is a direct influence on continuity and confidence in academic performance.

6.3 Socioeconomic Status and Participation

Table 5: Cross-tabulation of Income and Device Ownership

Income Level	Laptop Ownership (%)	Smartphone Only (%)
High income	73%	27%
Low income	29%	71%

Table 5 shows that there are high socioeconomic inequalities. High-income students have much greater access to laptops and reliable internet than low-income students.

Table 6: Regression Analysis (Income and Participation)

Predictor	β	t-value	p-value
Household income	0.62	6.11	< 0.001

The regression analysis confirms that the income is a good predictor of blended learning participation. More affluent students have increased chances of continuing to have access to digital learning platforms.

These findings are backed up by qualitative evidence. One of the students said, "I have siblings, and I share a phone; therefore, I tend to skip classes." One of them added that internet expenses were too expensive to engage in regularly.

6.4 Equity Implications of Blended Learning

Table 7: Correlation between Digital Access and Participation

Variable	Participation
Digital access index	r = 0.68**

(**p < 0.01)

Correlation analysis (Table 7) reveals that there is a strong positive relationship between digital access and blended learning participation. Those students who have higher access scores show to be much more academically engaged.

Table 8: Independent Sample t-test (High vs Low Access Groups)

Group	Mean Participation	SD	t-value	p-value
High access	4.21	0.54		
Low access	2.89	0.67	5.12	< 0.01

Table 8 shows that there is a big difference in the level of participation between the high-access and low-access students. This substantiates the fact that digital inequality is a direct influence on academic activity in blended learning.

Qualitative results also suggest a sense of exclusion by disadvantaged students, such as decreased teacher interaction, less teacher feedback, and decreased academic self-confidence.

7. Discussion of Findings

The results of this research are highly consistent with and contribute to available research on blended learning and digital inequality in post-secondary education. The results of the SPSS and qualitative data provide evidence that the participation in blended learning in Bangladeshi tertiary education is heavily influenced by the access to technology, geography, and socioeconomic status to validate previous claims by van Dijk (2020), Helsper (2021), and Warschauer (2004) that digital inequalities are complex and rooted in structure.

To begin with, regression outcomes ($R^2 = 0.47$, $p < 0.001$) indicate that internet stability and possession of devices are important predictors of blended learning participation. This observation aligns with the results of Aziz and Hossain (2024) and Islam and Sarker (2022), who also found that insecure connectivity and the absence of devices limit student engagement in the digital learning environment. The current research also reinforces these arguments by showing quantitatively that almost half of the variance in participation is attributed to digital infrastructure only, which shows the fact that blended learning effectiveness is highly contingent on basic technological preparedness.

Second, the results of the t-test ($t = 4.28$, $p < 0.05$) and ANOVA ($F = 6.54$, $p < 0.01$) indicate that the rural and urban areas differ significantly in infrastructure, which has been supported by Hossain et al. (2022) and Karim and Rahman (2021), who focused on the infrastr The present research builds on this fact and adds a direct association between the geographical difference and the behavior of participation in blended learning, demonstrating that rural students have access issues, as well as the lack of academic continuity and confidence. This confirms the idea of an access divide transforming into an outcome divide that is suggested by van Dijk (2020).

Third, socioeconomic status was a significant predictor of participation ($\beta = 0.62$, $p < 0.001$), which is also in line with the previous results reported by Sultana and Begum (2023) and Aziz and Hossain (2024) that financial constraints are a strong predictor of digital inclusion. The findings of the cross-tabulation (73% vs. 29% owning a laptop) vividly indicate the way economic inequality can lead to disparity in access

to educational facilities. Significantly, qualitative data further elaborate this by providing lived experiences of exclusion, including students sharing devices or skipping classes because of the cost of data, which resonates with Helsper's (2021) perspective that digital inequality is the product of more general socioeconomic capital.

Moreover, the high correlation between digital access and participation ($r = 0.68$, $p < 0.01$) is indicative of the systemic quality of the inequality in the blended learning setting. This result resonates with Bernard et al. (2014) and Halverson et al. (2015), who found that access quality is closely related to the results of technology-enhanced learning. But this study provides contextual evidence from Bangladesh, which indicates that the lack of equal access does not only influence performance but also imposes emotional impacts like stress, anxiety, and lack of academic confidence.

Psychological aspects of digital inequality are especially highlighted in the qualitative results, a field that has been previously under-researched in the quantitative literature. Students also indicated they felt excluded and frustrated and that they were not engaged in their academic activities, which confirms the argument of Digital Divide Theory that inequality is not only about access but participation and achievement as well.

In general, the synthesis of both statistical and narrative data supports the idea that blended learning, though pedagogically attractive (Garrison and Kanuka, 2004; Graham, 2006), is a threat to strengthening the structural inequalities in Bangladesh. The advantages of blended learning will not be evenly distributed without specific policy interventions, including the development of infrastructure, support, and training on using the device and digital literacy. Accordingly, this paper builds on the existing literature by offering empirical and contextual data that digital equity is a cornerstone of successful and inclusive blended learning and of developing higher education systems.

8. Conclusion

This paper has discussed the problem of equity and access to blended learning on the tertiary level in Bangladesh in light of digital divide theory. The results show that

technological obstacles and rural-urban and socioeconomic inequalities have a great impact on student participation. Although blended learning brings about flexibility and innovation in pedagogical approaches, its advantages are not distributed evenly. In the absence of sound policy responses, it will only contribute to the existing inequality in education. The research concludes that bridging the digital divide is not only a technological problem but also an educational justice problem. Sustainable blended learning in Bangladesh should thus be based on equity and accessibility as well as institutional responsibility.

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