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Study on the Modeling Guidelines for E-resource Employment in Goolgol Haor Campus in North Eastern Part of Bangladesh

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ABSTRACT

The haor regions of Bangladesh, particularly the Goolgol village of Netrokona District, are marked by seasonal flooding, geographic isolation, and limited infrastructure. These factors hinder traditional education and access to information. This study proposes a set of modeling guidelines for the deployment and sustainable employment of electronic resources (e-resources) in the Goolgol Haor Campus. The goal is to establish a resilient, inclusive, and accessible e-resource infrastructure that addresses digital divides and enhances educational outcomes. The study employs a mixed-methods approach combining field surveys, stakeholder interviews, and ICT feasibility analysis. Findings reveal that low-cost, solar-powered devices, community-shared digital kiosks, offline content repositories, and localized curriculum design are key to effective implementation. This paper offers a scalable framework adaptable to similar flood-prone and resource-scarce regions.

Keywords: Haor Region, E-resource Deployment, Goolgol Village, Haor Campus Model

1. Introduction

The northeastern region of Bangladesh, particularly the haor (seasonal floodplain) areas like Goolgol village in Netrokona District, presents a unique geographical and socio-economic context. These bowl-shaped wetland basins remain submerged for nearly half of the year, severely limiting infrastructure, transportation, communication, and access to essential services such as education. Inhabitants of these regions face substantial barriers in obtaining quality education, which is further compounded by poverty, seasonal displacement, and lack of digital access.

Traditional brick-and-mortar schooling systems struggle to operate consistently in the haor environment due to periodic floods, teacher absenteeism, and inaccessibility. In response to these challenges, the concept of a “Haor Campus” has emerged an educational initiative designed to integrate electronic resources (e-resources) into community-based learning centers. These centers aim to enhance digital inclusion, support remote learning, and empower rural youth with essential 21st century skills.

However, the successful deployment of such e-resource-based education systems requires more than technological intervention. It demands a context-sensitive and sustainable

modeling framework that considers the environmental vulnerabilities, infrastructure gaps, social dynamics, and resource limitations of the haor ecosystem. In this light, the present study investigates the practical challenges and proposes comprehensive guidelines for implementing e-resources effectively in the Goolgol Haor Campus.

The study aims to provide a scalable and replicable model that can bridge the digital divide in flood-prone and marginalized communities, transforming them into digitally empowered learning societies.

2. Objectives of the Study

The primary aim of this study is to develop a sustainable and context-specific model for employing electronic resources (e-resources) in the Goolgol Haor Campus, situated in the northeastern floodplain region of Bangladesh. The study seeks to bridge the digital divide and improve educational access in geographically and environmentally marginalized communities.

The specific objectives are:

1. To assess the current status of digital infrastructure and educational needs in Goolgol village and the surrounding haor areas.
2. To identify the socio-environmental challenges that affects the effective use of e-resources in haor regions.
3. To design a set of modeling guidelines for the sustainable implementation of e-resources in haor-based community learning centers.
4. To evaluate the feasibility of solar-powered, offline, and hybrid digital learning solutions tailored to haor conditions.
5. To recommend scalable strategies for stakeholder involvement, local ownership, and long-term operation of the Haor Campus model.

3. Literature Review

The use of electronic resources (e-resources) in education has gained global attention for its potential to reduce the digital divide and promote inclusive learning, particularly in underserved regions. In Bangladesh, several government and non-government initiatives have aimed to integrate ICT in education, but these efforts often fall short in geographically challenging environments like the haor areas. This section reviews key academic literature and policy documents that inform the modeling of e-resource deployment in rural and flood-prone contexts.

3.1 ICT in Rural and Marginalized Education

Bangladesh's National ICT Policy 2018 and the Education Policy 2010 highlight the need for integrating digital tools in education to enhance accessibility and quality. Studies by Zaman et al. (2017) and Haque & Akhter (2021) emphasize that while ICT adoption in urban schools has progressed, rural regions remain largely excluded due to infrastructural deficits and teacher training gaps. The issue is more acute in haor areas, where seasonal flooding disrupts both physical infrastructure and regular academic schedules.

3.2 E-resource Models in Developing Countries

Several studies provide frameworks for e-learning in low-resource settings. Trucano (2013) argues for the localization of content and community-driven ICT implementation. Heeks (2010) highlights the failure of many digital inclusion projects due to their one-size-fits-all approach. In contrast, community-centric, modular, and environmentally adaptable models show promise in Ethiopia (Kahsay et al., 2019) and India (Agarwal et al., 2016), where solar-powered ICT kiosks and offline LMS systems are used successfully in remote villages.

3.3 The Haor Context in Bangladesh

The Bangladesh Haor and Wetland Development Board (BHWDB) identifies 373 haor unions, many of which are seasonally isolated for 4–6 months. Research by Ahmed & Rahman (2020) found that education in haor areas is heavily disrupted due to physical inaccessibility and lack of teacher attendance during the rainy season. In a study of Kishoreganj and Sunamganj haor zones, Chowdhury et al. (2019) documented that floating schools and solar-powered learning centers significantly improved learning continuity during floods.

3.4 E-resource Adaptation in Flood-prone Areas

Offline Learning Management Systems (LMS) such as Kolibri**,** RACHEL**,** and KA Lite have emerged as scalable solutions in regions with limited internet. These platforms provide pre-loaded educational content, allowing users to access lessons without connectivity. A case study by Learning Equality (2021) in rural Nepal showed increased retention and engagement among students using solar-powered tablets loaded with Kolibri content.

3.5 Gaps in Existing Literature

Despite the growing body of work on ICT in education, there is limited literature focusing specifically on *customized modeling* of e-resource deployment in haor areas. Few studies account for seasonal accessibility, community ownership, and localized content delivery—critical aspects for long-term success in places like Goolgol. Additionally, while pilot programs exist, comprehensive modeling guidelines tailored to flood-prone rural areas remain underdeveloped and undocumented in scholarly discourse.

4. Methodology

This study employs a mixed-method research design, combining both qualitative and quantitative approaches to gather comprehensive insights into the practical, infrastructural, and socio-cultural dimensions of e-resource employment in the haor context. The methodology was designed to reflect the unique environmental challenges and educational limitations of the Goolgol village and surrounding floodplain communities.

4.1 Study Area: The study was conducted in Goolgol village, located within the haor belt of Netrokona District. The area was chosen due to its seasonal isolation, low educational attainment, and lack of digital infrastructure factors that make it representative of the broader challenges faced in haor regions.

4.2 Data Collection Methods

A. Primary Data

- **Household Surveys**: Structured questionnaires were used to collect information from 80 households regarding electricity access, digital literacy, and education levels.
- **Focus Group Discussions (FGDs)**: Conducted with parents, students, teachers, and community leaders to understand local perceptions of technology and education.
- **Key Informant Interviews (KIIs)**: Held with officials from local NGOs, education officers, and ICT practitioners working in rural development.
- **Field Observations**: On-site visits were carried out to document infrastructure, school conditions, flooding patterns, and existing technology use.

B. Secondary Data

- Government reports from the Haor and Wetland Development Board and Ministry of Education**.**
- Statistical data from Bangladesh Bureau of Statistics (BBS).
- Relevant academic articles and case studies on ICT in rural and flood-prone areas.

4.3 Analytical Tools and Techniques

- **SWOT Analysis**: To assess strengths, weaknesses, opportunities, and threats in implementing e-resources in haor environments.
- **GIS Mapping**: Used to locate flood-prone zones and determine spatial accessibility to proposed Haor Campus sites.
- **Feasibility Matrix**: Developed to evaluate potential technologies (e.g., offline LMS, solar panels, portable devices) against local constraints.
- **Content Analysis**: Applied to qualitative interview and FGD transcripts to extract recurring themes and community expectations.

4.4 Ethical Considerations

- **Informed Consent**: All participants were briefed about the study and consent was obtained before interviews or surveys.
- **Anonymity and Confidentiality**: Participants' identities were kept confidential; all data was anonymized during analysis.
- **Cultural Sensitivity**: Local dialects and customs were respected throughout the data collection process.

4.5 Limitations

- Limited access during the monsoon season constrained some fieldwork.
- Internet unavailability hindered live testing of cloud-based educational platforms.
- The study's findings are specific to Goolgol but may serve as a reference model for similar haor regions.

5. Results

Table 1: Household Digital Infrastructure and Access

Parameter	Number of Households (n=80)	Percentage (%)
Own at least one mobile phone	63	79
Own a smartphone	25	31
Have access to electricity	48	60
Have access to internet at home	10	12
Have previous experience with computers or digital devices	6	7
Interested in using digital learning resources	58	72

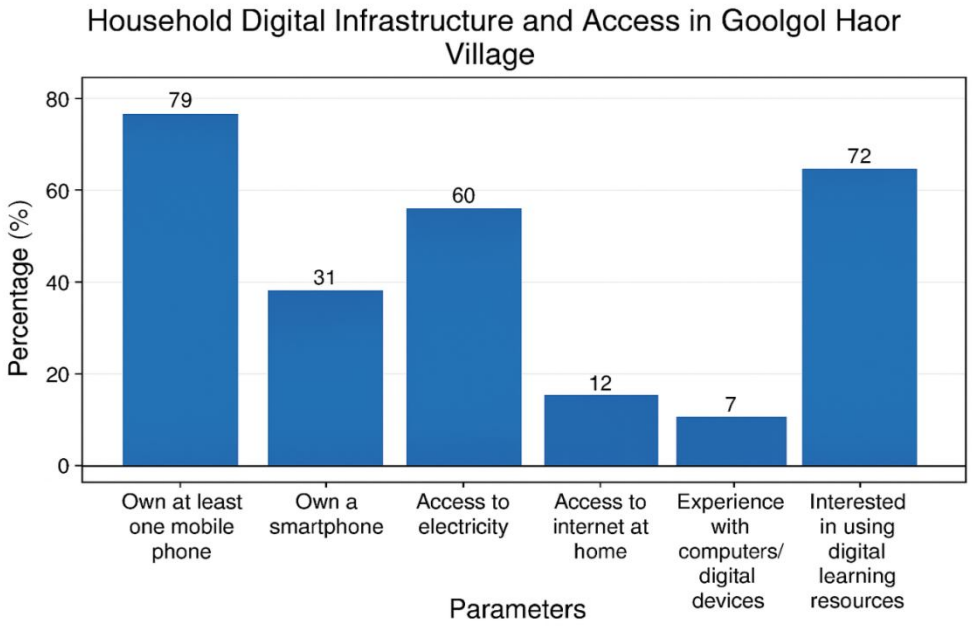

Figure 1: Household Digital Infrastructure and Access

The Table & figure summarizes the current status of digital infrastructure and technology access among 80 households in Goolgol Haor village. The findings show that the majority of households (79%) own at least one mobile phone, but only 31% have a smartphone. Access to electricity is available in 60% of households, whereas only 12% have internet connectivity at home. Furthermore, just 7% of households have prior experience using a computer or digital device. Despite these limitations, 72% of households expressed interest in using digital learning resources. These results indicate that while technology has not yet reached every household directly, there is significant community interest and readiness to adopt e-resource-based learning if appropriate infrastructure and support are provided.

Table 2: Community Readiness for E-resource Implementation

Aspect	Findings	Interpretation
Digital literacy level	Low (majority have basic familiarity only)	Training programs needed
Attitude towards e-learning	Positive	Willingness to adopt if devices are accessible
Teacher/Youth facilitator availability	Moderate	Local youth can be trained as digital facilitators
Community engagement	High interest in participation	Essential for ownership and sustainability

Table 2 presents the findings on community readiness for implementing e-resources in Goolgol Haor village. The results indicate that overall digital literacy is low, with most community members having only basic familiarity with digital devices. However, the attitude toward e-learning is largely positive, suggesting that residents are willing to adopt new learning technologies if they are accessible and practical. Availability of teachers and local youth as potential digital facilitators is moderate, highlighting an opportunity to train local youth to support and maintain e-learning systems. High community interest in participation underscores the importance of involving local stakeholders in planning and governance to ensure ownership, sustainability, and culturally appropriate content delivery for the Haor Campus model.

Table 3: Feasibility of Technology Options for Goolgol Haor Campus

Technology / Tool	Feasibility	Constraints	Recommendation
Solar-powered devices	High	Initial cost, maintenance	Use durable, waterproof models
Offline LMS (Kolibri, RACHEL)	High	Needs pre-loaded content	Deploy offline servers and tablets
Cloud-based LMS	Low	Unreliable internet	Not recommended in flood season
Floating/modular classrooms	Medium	Construction cost	Useful for long-term continuity during floods

Table 3 evaluates the feasibility of different technological options for implementing e-resources in the Goolgol Haor Campus. The findings indicate that solar-powered devices are highly feasible, as they provide a reliable power source despite limited electricity, though initial costs and maintenance requirements must be considered. Offline Learning Management Systems (LMS) such as Kolibri and RACHEL are also highly feasible, allowing students to access preloaded educational content without internet connectivity. In contrast, cloud-based LMS platforms are considered low feasibility due to unreliable internet access in the haor region, particularly during flood seasons. Floating or modular classrooms show medium feasibility they offer a practical solution for maintaining learning continuity during floods but require significant construction investment. Overall, the table highlights the need for context-sensitive technology choices that account for environmental constraints and local infrastructure limitations.

Table 4: Proposed E-resource Employment Model Components

Component	Description	Key Benefit
Solar-powered infrastructure	Solar panels & battery backups	Ensures uninterrupted power
Offline digital content	Preloaded tablets, servers	Learning continuity without internet
Community facilitators	Trained local youth	Sustainability and maintenance
Localized curriculum	Bangla & dialect content, flood awareness, vocational skills	Contextual relevance
Modular/floating classrooms	Adaptable learning spaces	Functionality during seasonal floods

Table 4 outlines the key components of the proposed e-resource employment model for the Goolgol Haor Campus. The model emphasizes a solar-powered infrastructure, ensuring uninterrupted electricity for digital learning hubs. Offline digital content, delivered via preloaded tablets and local servers, enables students to continue learning without reliance on internet connectivity. Community facilitators, particularly trained local youth, are integral to maintaining devices, providing technical support, and ensuring sustainability. The localized curriculum, including Bangla and local dialect content as well as lessons on flood awareness, sustainable livelihoods, and vocational skills, ensures contextual relevance. Finally, modular or floating classrooms are proposed to maintain continuity of education during seasonal flooding. Collectively, these components create a resilient, community-centered, and environmentally adaptive learning ecosystem suitable for flood-prone haor regions.

6. Discussion

The findings from this study highlight the urgent need for a context-specific, environmentally adaptive, and community-led model for deploying e-resources in haor areas like Goolgol village. Unlike urban or even general rural areas, haor regions present a unique combination of challenges: seasonal flooding, weak infrastructure, and socio-economic deprivation. These realities must guide the implementation of any educational technology initiative.

6.1 Understanding the Haor Reality

The Goolgol Haor Campus is not just an educational institution it is envisioned as a community innovation hub operating under extreme environmental conditions. Seasonal isolation due to flooding renders traditional educational methods ineffective for at least four to six months each year. Schools either remain closed or function irregularly, while students become disengaged due to long academic gaps.

This seasonal disruption underscores the need for hybrid offline-online digital learning models, where e-resources such as preloaded learning devices, solar-powered servers, and floating classrooms can operate independently of physical infrastructure and consistent internet access.

6.2 Community Readiness and Digital Literacy

The community exhibited a moderate level of digital curiosity but low actual literacy. Many parents and teachers, despite having limited formal education themselves, expressed a strong willingness to adapt to new systems if they were accessible and practical. This finding reinforces the importance of inclusive training programs for digital facilitators selected from the local youth population who can maintain devices, provide tech support, and help students navigate learning platforms.

Moreover, any model that is externally driven or fails to involve the community risks being abandoned or unsustainable. Thus, community ownership and localized governance structures are not supplementary they are essential components of a successful model.

6.3 Technology Choices Must Reflect Environmental Constraints

Conventional ICT deployments assume reliable electricity and internet connectivity assumptions that collapse in Goolgol's environment. Based on field data, the following adaptations are vital:

- Solar energy is the only reliable power source.
- Offline Learning Management Systems (e.g., Kolibri) are more feasible than real-time cloud-based solutions.
- Devices must be rugged, portable, and waterproof to withstand the haor's physical conditions.
- Infrastructure such as floating or modular classrooms must be considered to ensure year-round continuity.

6.4 Curriculum and Content Must Be Localized

Students in Goolgol are not just underserved; they are underserved in a specific, *contextual* way. The absence of content in Bangla and the local dialect, and the lack of relevance to the community's life (fishing, agriculture, flood preparedness), makes imported e-learning resources ineffective.

The study recommends a curriculum that blends standard national education with localized content, including:

- Audio-visual tutorials in Bangla
- Lessons on sustainable fishing and flood awareness
- Vocational training for out-of-school adolescents

6.5 Replicability and Policy Implications

While the study focuses on Goolgol, the findings are scalable to other haor areas such as Sunamganj, Kishoreganj, and Habiganj. However, replication depends on:

- Customizing the model to local conditions (e.g., flood duration, population density)
- Policy support from the government to fund solar infrastructure and teacher training
- Partnerships with NGOs and EdTech organizations to provide content, hardware, and training

If embedded into the government's Digital Bangladesh vision, this model could serve as a national template for digital education in flood-prone areas.

7. Conclusion

This study has explored the design and modeling guidelines necessary for effective and sustainable employment of e-resources in the Goolgol Haor Campus, situated in one of the most environmentally challenged regions of Bangladesh. The findings clearly indicate that traditional education models heavily reliant on infrastructure, stable weather, and uninterrupted teacher presence are inadequate for haor regions, where monsoon flooding and isolation are part of everyday life.

To address these constraints, the study proposes a localized, community-centered, and environmentally adaptive framework. The model integrates solar-powered digital infrastructure, offline learning systems, modular learning spaces, and culturally contextualized content to ensure educational continuity and relevance. Equally critical is the emphasis on community involvement empowering local youth as digital facilitators and promoting shared ownership of learning resources.

The Goolgol Haor Campus thus becomes more than just a school it becomes a resilient learning ecosystem capable of withstanding seasonal disruptions and building long-term human capacity. While tailored to Goolgol, the guidelines presented are scalable and adaptable to other flood-prone, remote, and marginalized areas in Bangladesh and beyond.

If implemented with supportive policy frameworks and strategic partnerships, this model has the potential to transform digital education access in haor areas from a privilege for the few to a right for all.

8. Recommendations

Based on the findings and discussion, the following recommendations are proposed to ensure the successful deployment and sustainable employment of e-resources in Goolgol Haor Campus and similar flood-prone regions:

7.1 For Policy Makers

- **Incorporate Haor-Specific Digital Education Policies:** Develop tailored guidelines within the national ICT and education policies that specifically address the unique challenges of haor and flood-prone areas.

- **Provide Financial Support for Solar Infrastructure:** Allocate grants or subsidies for solar power systems and maintenance to ensure uninterrupted electricity supply for digital learning hubs.

- **Support Teacher Training Programs:** Invest in capacity building for teachers and local digital facilitators on using e-learning tools and managing offline digital platforms.

7.2 For Educational Institutions and NGOs

- **Engage Local Communities:** Foster active participation of local stakeholders in planning, implementation, and governance to build ownership and ensure culturally appropriate content.

- **Develop and Localize Content:** Create e-learning materials in Bangla and local dialects, integrating haor-specific knowledge such as flood preparedness and sustainable livelihoods.

- **Implement Hybrid Learning Models:** Combine offline and limited online resources to mitigate connectivity challenges during flood seasons.

7.3 For Technology Providers

- **Design Robust, Portable Devices:** Manufacture solar-compatible, waterproof, and durable devices suitable for haor environmental conditions.

- **Offer Offline Learning Platforms:** Support deployment of Learning Management Systems like Kolibri and RACHEL that function effectively without continuous internet.

- **Provide Training and Technical Support:** Ensure ongoing user training and maintenance services are available locally to build self-sufficiency.

7.4 For Donor Agencies and Development Partners

- **Promote Scalable Pilot Projects:** Fund initiatives that demonstrate model replication in other haor districts, documenting best practices and lessons learned.

- **Facilitate Multi-stakeholder Collaboration:** Encourage partnerships between government, academia, NGOs, and the private sector for resource sharing and coordinated development.

- **Support Monitoring & Evaluation Systems:** Invest in tools to collect usage data and learning outcomes to refine models and measure impact over time.

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