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TECHNICAL REPORT

Elevating Education at High Altitude

EdTech implementation in Gilgit-Baltistan

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Authors M. Nawaz Aslam
Haani Mazari
Amal Hayat
Syed Mustafa Hassan
Nimra Afzal
Jazib Zahir
Sajad Khan (Ministry of Federal Education and Professional Training, Pakistan)

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Abbreviations and acronyms

DDE	District Director of Education
DDO	Drawing and Disbursement Officer
EMIS	Education management information systems
FCDO	Foreign Commonwealth Development Office
ICT	Information communication technology
IT	Information technology
LMS	Learning management system
LMIC	Low- and middle-income country
M&E	Monitoring and evaluation
STEAM	Science, technology, engineering, arts, and mathematics
STEM	Science, technology, engineering, and mathematics
TAKMIL	Teach a Kid Make Individual Life

Executive summary

In August 2023, Pakistan's Government of Gilgit-Baltistan and the United Kingdom's Foreign, Commonwealth and Development Office (FCDO) in Pakistan requested EdTech Hub to conduct a study that examines the government's education technology (EdTech) initiatives in the region. Gilgit-Baltistan's complex geography created challenges, including geographic isolation and infrastructural limitations. The Government of Gilgit-Baltistan has introduced EdTech to address educational challenges while endeavouring to create employment opportunities through digital skills development. This report explores Gilgit-Baltistan's 'STEAM' (science technology, engineering, arts, and mathematics) and 'Smart Schools' interventions to highlight the transformative potential of targeted educational reforms and EdTech solutions, which were designed to help overcome some of the implementation challenges posed by Gilgit-Baltistan's rugged terrain and socio-economic constraints.

While technology offers the potential to overcome the barriers of isolation, several infrastructural and capacity challenges prevent equitable access to electricity and internet connectivity. The mountainous topography, frequent landslides, scheduled and unscheduled power outages ('load shedding'), and unreliable internet connectivity create infrastructural barriers to access. However, merely overcoming these infrastructural challenges alone will not guarantee effective implementation. EdTech implementation requires a symbiosis between teacher needs and infrastructural needs. For this reason, this study focuses on Gilgit-Baltistan's investments in these two aspects by exploring infrastructural design and capacity-building measures, including Gilgit-Baltistan's 'Tech Fellows' initiative, through which information technology (IT) graduates support teachers in the classroom.

This report is intended as a crucial resource for policymakers, educators, and stakeholders in Gilgit-Baltistan and similar regions worldwide. It provides a detailed account of the educational challenges and opportunities in the region, offering a roadmap for leveraging EdTech and educational reforms to improve access, quality, and outcomes in education. The considerations presented in the report, and summarised below, aim to guide future efforts to create more equitable and effective EdTech implementation in Gilgit-Baltistan and beyond. The report focuses on infrastructure and capacity alignment, as well as programme management and evaluation.

1. Infrastructural alignment

The following considerations regarding contextual infrastructural alignment present opportunities to enhance the EdTech implementation processes in Gilgit-Baltistan. While the research focused on specific EdTech implementations in Gilgit-Baltistan, the findings may well have value for enhancing and implementing EdTech solutions in low-resource and remote contexts around the world.

- Teachers and students in Gilgit-Baltistan value offline local learning hotspots created in targeted schools with preloaded educational content. EdTech implementers globally can learn from this and design EdTech interventions that align with schools' infrastructural needs.
- Needs assessments should include data beyond digital infrastructure availability. Understanding school-level infrastructure, including the number of available classrooms, is critical to EdTech implementation.
- Winter months impact solar energy reliability. We recommend exploring investing in weather-resilient solarisation efforts, such as frameless solar panels or power storage tools like battery packs.

2. Capacity alignment

Simply investing in technology and hardware is not enough to ensure positive results for an intervention; capacity building and alignment also play a critical role.

- Investing in support personnel like Tech Fellows can help classroom integration. For a sustained impact on teacher professional development, teachers should be incentivised to learn from the support resource.
- Testing available content with local communities to ensure cultural relevance is vital. If using repurposed content, one solution is to consider developing a glossary that translates technical terms to overcome linguistic barriers.
- Providing lesson plans can support teachers in facilitating structured pedagogy throughout a programme.

3. Programme management and evaluation

Enhancing communication during the design and implementation process, as well as collecting rapid data and responding to learnings from pilot programmes, can bring added value to implementation.

- To enhance communication and coordination, sharing information on a programme's aim and the defined roles and responsibilities of each school-level stakeholder (teachers and principals) is essential.
- Pilot programmes can help test the effectiveness of different approaches and identify potential challenges, thus allowing for adjustments based on actual needs before full implementation.
- Data integration can offer ongoing insights into school and student needs, helping to tailor interventions effectively. Regular assessments and feedback mechanisms can inform the continuous improvement of educational programmes.

1. Introduction

Gilgit-Baltistan, located in the northernmost part of Pakistan, is a region known for its high-altitude geography. Marked by the convergence of three major mountain ranges: the Karakoram, the Himalayas, and the Hindu Kush, this area is renowned for containing some of the world's highest mountains, including K2, the world's second-highest peak (↑Aziz, 2024). Gilgit-Baltistan's complex geography creates challenges for implementing EdTech, such as geographic isolation and infrastructural limitations. While technology offers the potential to overcome the barriers of isolation, several infrastructural and capacity challenges prevent equitable access to electricity and internet connectivity.

Figure 1. *The Mountains of Gilgit-Baltistan. Source: Furqan LW, Creative Commons License.*

Like many parts of the world, the Government of Gilgit-Baltistan has implemented various EdTech initiatives to address education challenges with the hope of making learning more engaging for students in line with Gilgit-Baltistan's Education Strategy (2015–2030) (↑Education Department of Gilgit-Baltistan, 2014). Two such interventions are the 'STEAM' (science, technology, engineering, arts, and mathematics) intervention, which aims to enhance students' aptitude in the sciences, and the 'Smart Schools' intervention that seeks to improve teaching practices and learning outcomes through blended learning.

The approach adopted by the Government of Gilgit-Baltistan and its partners in implementing EdTech renders Gilgit-Baltistan, a low-resource context, a distinctive region to study for three reasons. First, the government [1] has invested in 'Tech Fellows' (IT graduates who support teachers with classroom integration) to bridge the gap between limited digital skills and implementation requirements. Second, to address infrastructural challenges, the government has experimented with solarisation and the offline availability of a learning management system (LMS) with preloaded digital educational content. Third, the government's strategy has integrated digital literacy acquisition with entrepreneurship to engage students through pathways to employment in STEAM fields actively.

Although the government has invested in monitoring and evaluation (M&E) processes for each programme, there is limited research that considers the strengths and opportunities in Gilgit-Baltistan's EdTech implementation model holistically. In this study, we explore the multifaceted aspects of EdTech implementation in Gilgit-Baltistan by supplementing a desk review with key informant interviews.

1.1. Rationale for the study

The rationale for this study is rooted in the unique challenges faced by Gilgit-Baltistan. The study is motivated by recent transformative education reforms in the region, including the use of technology in initiatives for STEAM and Smart Schools. According to stakeholders, these EdTech initiatives in government schools are intended to equip students with 21st-century skills, increase student engagement, bolster enrolment, and improve educational outcomes. Due to limitations in existing data, this study will not explore efficacy but will unpack stakeholder perceptions of EdTech implementation.

The intended outcome of this approach is two-fold:

- By investigating the government's reforms and initiatives, the study seeks to identify good practices and provide further recommendations to enhance EdTech implementation in Gilgit-Baltistan.
- The study's findings can bolster implementation in other low-resource settings with limited teacher capacity within Pakistan and internationally by exploring the challenges and opportunities in Gilgit-Baltistan's blended learning implementation model.

[1] In Pakistan, the 18th Constitutional Amendment devolved educational decision-making to the provinces. Unless otherwise stated, the shorthand use of 'the government' in this report refers to the Government of Gilgit-Baltistan.

2. Literature review

This section begins with a literature review of research on the EdTech landscape in Gilgit-Baltistan, which includes the status of education, education reform, and technology access. Based on these insights, we draw upon research on blended learning implementation from an infrastructural and teacher capacity approach in low- and middle-income countries (LMICs).

2.1. The EdTech landscape in Gilgit-Baltistan

This section provides context on EdTech in Gilgit-Baltistan, the state of education in the region, education reform, and technology access.

2.1.1. Status of education in Gilgit-Baltistan

The Gilgit-Baltistan Multiple Indicator Cluster Survey 2016–17 (↑Government of Gilgit-Baltistan & UNICEF, 2017) is a significant source of education statistics in Gilgit-Baltistan. According to the report, 49% of children of primary school age attend school; the figure is slightly higher for males (53%) than females (46%). More than 50% of children are defined as being out of school, while 24% of children have never attended school (↑Government of Gilgit-Baltistan & UNICEF, 2017: p. 16)

Data from the *Annual Status of Education Report ASER-Pakistan 2023* (↑ASER, 2024) exemplifies advancements in education for Gilgit-Baltistan. In Urdu and English, Grade 5 students in Gilgit-Baltistan surpassed the national average. Results in Urdu proficiency increased by 8%, and English proficiency rose by 6% compared to the previous year (↑ASER, 2024: p. 88). This contrasts with Pakistan's national proficiency, where Urdu proficiency decreased from 54% to 50% and English proficiency from 56% to 54% (↑ASER, 2024: p. 48).

Nonetheless, like many parts of Pakistan, Gilgit-Baltistan faces educational challenges that impact access to quality and equitable education. While socio-economically disadvantaged students, girls, and rural students face more barriers to accessing education, according to the Gilgit-Baltistan Education Strategy (2015–2030), schools lack sufficient educational resources, and teachers have limited capacity. Furthermore, like much of Pakistan, high student-to-teacher ratios make it challenging for teachers to facilitate student-centred learning (↑Education Department of Gilgit-Baltistan, 2014).

Gilgit-Baltistan's Education Strategy (2015–2030) aims to introduce a "dynamic, effective, efficient and equitable education system" by

introducing initiatives focused on students, teachers, and institutions. By 2030, Gilgit-Baltistan seeks to make the classroom a "stimulating learning environment" that is a "learning space" for the community and leverages "active, student-centred learning" (↑Education Department of Gilgit-Baltistan, 2014: p. 14). In addition to investments in EdTech, institutional and teacher capacity-building initiatives have been underway to achieve this vision, which may have the potential to have a sustained impact.

2.1.2. Education reform in Gilgit-Baltistan

Institutional capacity building: Recent reforms in Gilgit-Baltistan have focused on empowering education leaders and integrating technology into the learning process. A significant reform was the DeliverEd Initiative, funded by the UK Government's Foreign, Commonwealth, and Development Office (FCDO) and led by the Education Commission.[2] The initiative sought to "rapidly improve bureaucrats' performance and service delivery" and empower head teachers as Drawing and Disbursement Officers (DDOs), granting them financial and administrative autonomy to meet the needs of their schools more effectively. This reform, initiated in March 2023, aims at decentralising authority, thereby reducing systemic stress and enhancing the operational efficiency of schools at the local level (↑Jamil, 2023).

Teacher capacity building: The Government of Gilgit-Baltistan has significantly increased its funding for the education sector, with a threefold rise in 2023 compared with the previous year, demonstrating its commitment to improving educational standards and access in the region (↑DAWN News, 2023). The increased funding is essential for sustaining and expanding educational initiatives, such as the partnership between Aga Khan University and the government to boost teacher capacity. This project focuses on training 1,000 new teachers in modern pedagogical methods, 21st-century skills development, game-based teaching, community engagement, and EdTech, which is expected to significantly impact the quality of education in Gilgit-Baltistan (↑Aga Khan University, 2023).

2.1.3. Technology access in Gilgit-Baltistan

The most recent data available on household access to technology in Gilgit-Baltistan is from ↑ASER Pakistan (2024: p. 95):

- As much as 91% of rural households surveyed had mobile phones, while 74% had smartphones.

[2] See https://educationcommission.org/about/ for more details about the work of the Education Commission. Retrieved 24 June 2024.

- However, only 30% of rural households surveyed had reliable internet connectivity.
- Just 5% of the government secondary schools surveyed had internet access, and 8% had computer labs.

Although this data is specific to rural parts of Gilgit-Baltistan, these figures have not changed significantly over the past five years. Data from the 2016–2017 Multiple Indicator Cluster Survey shows that 98% of urban and 90% of rural households had access to mobile phones (↑Government of Gilgit-Baltistan & UNICEF, 2017; ↑Wilson et al., 2022).

2.2. Evidence from similar implementation contexts

There is limited research about implementing EdTech in Gilgit-Baltistan or, more broadly speaking, in Pakistan's low-resource settings. As a result, it is critical to unpack key literature on implementing EdTech in LMICs. Two of the most pertinent themes in implementation relate to the teacher's role in EdTech implementation and designing EdTech interventions that are feasible for low-resource environments.

Figure 2. *The teacher's role in implementing EdTech*

There is a common misconception that digital learning solutions can eventually replace the role of a teacher. In fact, recent literature crucially emphasises the critical role teachers play in the efficacy of in-school EdTech interventions (↑Cavanaugh & DeWeese, 2020; ↑D'Angelo et al., 2024; ↑Hennessy et al., 2021). For example, in the Dominican Republic, ↑D'Angelo et al. (2024) found that teachers played a key role in monitoring student progress, motivating students, and providing additional explanations and support. As a result, teachers raised concerns about facing challenges with "juggl[ing] their regular lesson planning" with EdTech-related support (↑D'Angelo et al., 2024: p. 25)

Research highlights the importance of developing a classroom or school environment conducive to blended learning to support teachers with blended learning interventions. Poor infrastructure, unreliable or intermittent internet connectivity, high data costs, or a lack of battery power for devices are common challenges (↑Adil et al., 2021; ↑Upadhyay et al., 2020) that can lead to frustration and discouragement among students and school personnel (↑Ferede et al., 2022). Considering attitudes towards infrastructural needs is particularly important in a context like Gilgit-Baltistan, where most households do not have access to reliable internet.

The Government of Malawi's Building Education Foundations through Innovation & Technology (BEFIT) programme sought to address infrastructural challenges by partnering with an EdTech provider and an off-grid energy provider. Through this programme, the government seeks to make content available offline on tablets that can be charged via solar energy (↑Sun King, 2024).

According to ↑Zubairi et al. (2022), offline EdTech interventions have already been tested in Pakistan. An example is a solution developed by TAKMIL (*Teach a Kid Make Individual Life*) that offers accelerated learning for children who have never attended school. The solution is implemented in low-resource settings and thus consists of an offline LMS that hosts digital learning content (↑Zubairi et al., 2022). Through its implementation journey, TAKMIL found that facilitator training and solar-powered hardware were key to bringing solutions to scale in Pakistan, given widespread infrastructure and capacity challenges (↑Zubairi et al., 2022).

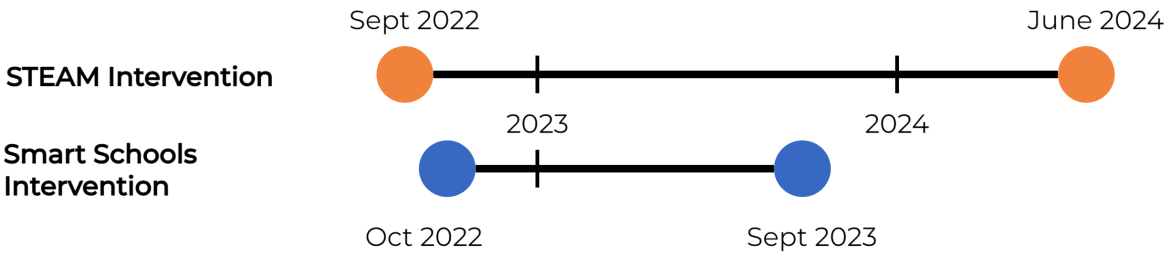
However, overcoming infrastructural challenges alone will not guarantee effective implementation. EdTech implementation requires symbiosis between teacher needs and infrastructural needs. For this reason, this study focuses on Gilgit-Baltistan's investments in these two aspects.

2.3. EdTech interventions in Gilgit-Baltistan

This section draws on the Government of Gilgit-Baltistan's requests for proposals and intervention reports to develop an overview of the instructional and infrastructural implementation of two interventions under the scope of this study: the STEAM and Smart Schools interventions.

The rationale for exploring these two initiatives, in particular, relates to their overlapping implementation timelines. Furthermore, the challenges stakeholders sought to address during each implementation were similar, providing an opportunity to analyse how key stakeholders experienced implementation. Still further, there was considerable overlap in the beneficiaries of these interventions, and stakeholders mentioned them interchangeably in their interviews.

Figure 3. *Intervention timelines*



Despite the overlapping implementation timelines, the interventions had contrasting approaches to achieving the government's aim of enhancing student engagement and revitalising the classroom. The sections below highlight how these two interventions were implemented in line with their aims.

Table 1. *Overview of the interventions*

	STEAM intervention	Smart Schools intervention
Objective	Digital literacy and problem-solving in 200 schools (Grades 6–8)	Digital learning environment in 37 schools (Grades 6–12)
Infrastructural approach	Prerequisite to have a computer lab, internet connectivity, and electricity.	Internet connectivity not required; the LMS was available offline through a wireless local area network (WLAN).
Classroom integration	100 IT graduates were trained to teach at two schools each.	Each school was allocated IT graduates (Tech Fellows) to support teachers with classroom integration.

2.3.1. The STEAM intervention (September 2022–June 2024)

In partnership with the Rupani Foundation as the private service provider, the STEAM intervention was designed to deliver computer education, STEM (science, technology, engineering, and mathematics), and entrepreneurship courses to promote digital literacy and problem-solving skills to Grades 6–8 across 200 secondary schools in Gilgit-Baltistan.[3] The intervention's objectives were to:

- Provide students with a foundation in ICT that promotes 21st-century skills like creativity, problem-solving, and informed decision-making.
- Enhance students' capability to construct, explore, prototype, evaluate, foster logical thinking, solve problems, and collaborate using digital tools.
- Prepare students to become responsible global digital citizens.
- Promote entrepreneurship skills through a designated course.

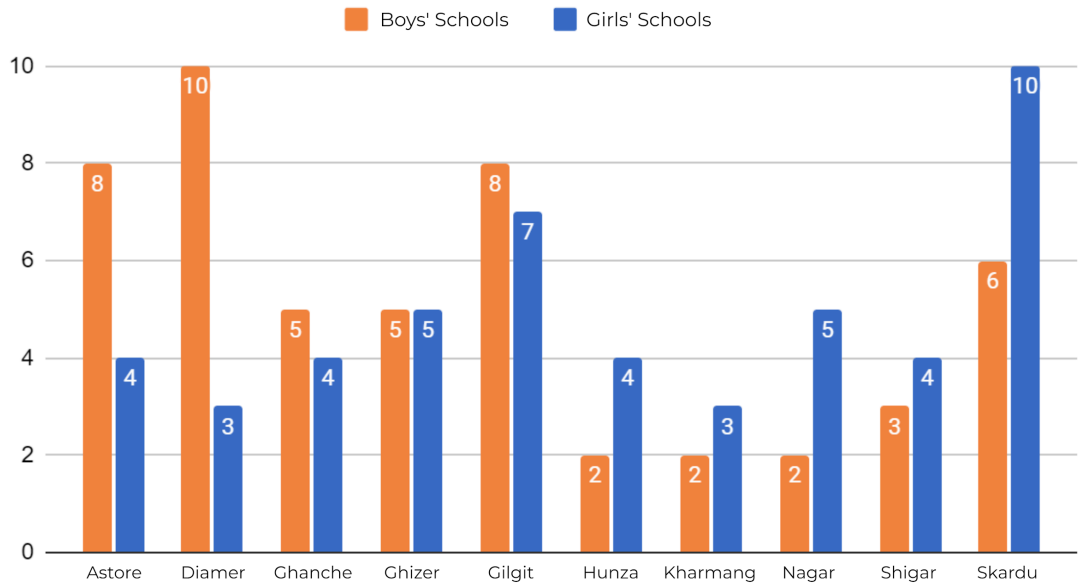
The STEAM model

According to the government's request for proposals, 100 IT teachers facilitated the course, which aimed to implement a 'project-based' and

[3] Two components of the STEAM intervention focus on 'STEM' through computer science and digital skills. The third component of entrepreneurship is considered to be 'arts'.

'hands-on learning approach.' According to an internal report by Rupani Foundation, of the 200 schools, 93 were girls' schools, and 107 were boys' schools (see Figure 4 below for a breakdown of schools by district and gender).

Figure 4. *Distribution of STEAM schools by district and gender*



The STEAM model: Hiring and training

100 IT teachers were hired to teach at two schools each to facilitate the programme. According to stakeholder interviews, these teachers had at least 16 years of proficiency in using technology and received 15 days of training about implementing the STEAM intervention.

The STEAM model: Classroom instruction

Teachers were provided with digital content, lesson plans, teaching aids, and project materials developed by the Rupani Foundation and its partners. Teachers taught courses by grade level and dedicated at least one hour of teaching time per course per grade every week.

The STEAM model: Infrastructure

Given the scale of the programme and the varying remoteness of the 200 target schools, ensuring proper infrastructure, such as hardware, electricity, and internet connectivity, was a challenge.

The regional government provided infrastructure, which was not the Rupani Foundation's responsibility. Schools with all the necessary infrastructure, such as IT labs, electricity, and the internet, were selected for the intervention.

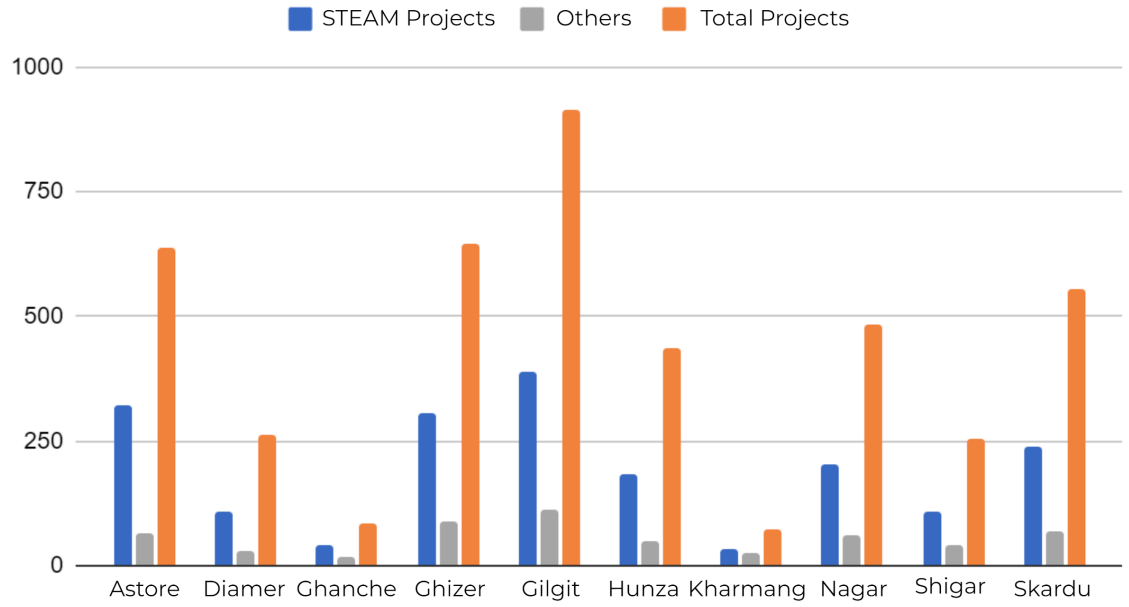
However, according to stakeholder reports, the schools did not have uniform quality of or access to infrastructure.

School visits and stakeholder interviews conducted before the intervention's implementation revealed that the devices in some schools were outdated, the electricity supply was unreliable, and internet connectivity was often non-existent or patchy.

The STEAM model: Increasing engagement

To increase student engagement and incentivisation, the Government of Gilgit-Baltistan held school and district-based STEM project exhibitions in June and July 2023, hosted in collaboration with the private provider. The exhibitions were held across five different locations and provided 1,050 participants the opportunity to showcase their projects and demonstrate their learnings and creativity. The top-performing participants were given the opportunity to travel to Pakistan’s capital, Islamabad, to present their projects to the prime minister.

Figure 5. *Student projects by district*



2.3.2. The Smart Schools intervention (October 2022–October 2023)

In partnership with GBtechive, a technology consultant based in Gilgit-Baltistan, the Smart Schools intervention aimed to provide students from Grades 6 to 12 with access to quality digital learning in a blended learning environment.

The intervention includes providing an LMS with curriculum-aligned content and accompanying hardware, infrastructure, and school-level support to facilitate the use of blended learning in 37 secondary and higher secondary schools across 10 districts of Gilgit-Baltistan.

As the targeted schools did not require connectivity or electricity, the government worked with GBtechive to make several provisions to provide alternative infrastructural support.

The Smart Schools model

The Smart Schools blended learning intervention aimed at increasing access to quality digital learning for students across Grades 6 to 12. Schools with connectivity were envisaged as remote learning hotspots, whereby schools without connectivity could access curated digital learning content that is curated and aligned with the federal curriculum. The intervention used a holistic design approach underpinned by hardware provision, infrastructural support, and classroom integration guidance from a full-time Tech Fellow. The intervention deployed a low-cost, uninterrupted, technology-based, two-way communication and study assessment

mechanism as an offline LMS, available for access through a wireless local area network (WLAN).

Smart Schools implementation: Hardware provision

The selected schools had computer labs that ranged from operational and up-to-date to nonfunctional with obsolete equipment. As the intervention required up-to-date hardware, the Government of Gilgit-Baltistan partnered with GBtechive to procure one 65" LED screen and 20 Chromebooks for each school.

Smart Schools implementation: Infrastructural response

Due to the schools' remote locations, internet connectivity and constant electricity supply were a great challenge. However, since internet connectivity and electricity supply were not considered prerequisites for the schools selected for this programme, the government and its partners made several other infrastructural responses.

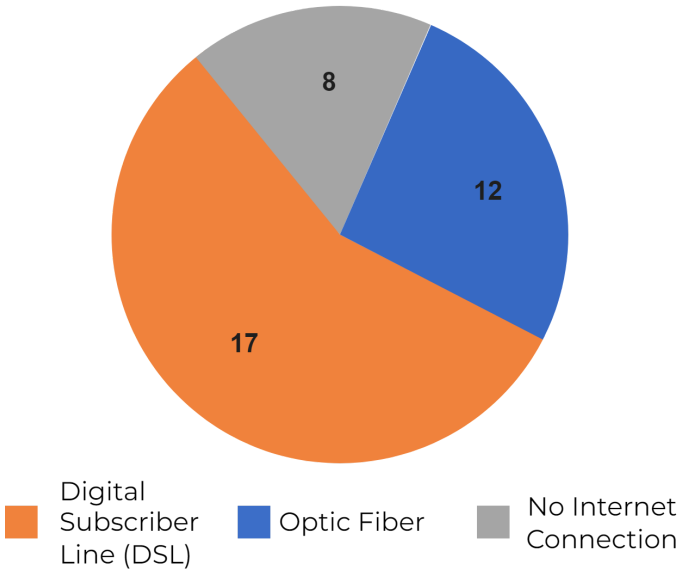
Only 54% of the project schools had internet connectivity, so a local intranet to provide offline LMS access to computer labs and/or classrooms was included in the intervention design. These schools are set up with local servers that contain educational material and function as learning hotspots in these remote locations.

Creating the hotspots described above has helped to overcome the challenge of weak broadband/internet penetration. The hotspots allow schools to access curated educational content housed in the LMS, even without internet connectivity.

All 37 schools had access to electricity, but the supply was intermittent.

Alternative power sources were provided in the form of solar solutions with accompanying UPS (Uninterrupted Power Supply) and batteries for backup.

Figure 6. *Distribution of internet connectivity access across Smart Schools*



Smart Schools implementation: Classroom integration

The intervention also aimed to expose teachers to technology in the classroom and strengthen their capacity to use innovative technology-based teaching and learning management methods. A Tech Fellow was assigned to each school to support teachers in the classroom. The implementing partners trained the Tech fellows to use the LMS and support classroom integration by:

- Providing on-demand tech support and guiding teachers to provide scaffolding for students
- Training teachers to use the LMS
- Operating and managing the software and hardware to ensure connectivity is maintained, the software is up-to-date, and the hardware is stored safely.
- Sharing LMS data on student attendance and performance with teachers and principals.

Smart Schools implementation: Educational and instructional content

The private partner, GBtechive, provided educational content aligned with the federal curriculum and accessible on the offline LMS. To make the

content more accessible, the government chose Urdu as the language of instruction.

Smart Schools implementation: Monitoring and evaluation

Data collected through the LMS is hosted on a cloud-based server with a centralised dashboard that can be accessed by the Government of Gilgit-Baltistan's Education Department and GBtechive, which maintains the dashboard. Local dashboards for teachers and principals were also featured in the LMS to help them monitor and evaluate student and teacher performance. Where an internet connection is unavailable, a flash drive is used to gather data, which is then synced with the server by the Tech Fellows, who transport it to the nearest region with high-speed internet once or twice a month.

3. Research design and methodology

This section unpacks the design and the methodology that shaped this study. This study aimed to research the attitudes of the stakeholders in Gilgit-Baltistan about the EdTech interventions being implemented and to determine the challenges and opportunities presented by these interventions. Key informant interviews and classroom observations were used to gather data. Further analyses of the qualitative data and findings were synthesised and consolidated.

3.1. Research design

This study explores the following research questions:

1. What are key stakeholders' attitudes towards existing EdTech interventions in Gilgit-Baltistan?
    - The study investigates the government's reforms and initiatives to identify good practices and provide recommendations to enhance EdTech implementation in Gilgit-Baltistan further.
2. What are the key strengths and opportunities that shape Gilgit-Baltistan's approaches to implementing EdTech?
    - The study's findings can bolster implementation in other low-resource settings with limited teacher capacity within Pakistan and internationally by exploring the challenges and opportunities in Gilgit-Baltistan's blended learning implementation model.

To explore these questions, we adopted a comprehensive qualitative research design. We supplemented qualitative data with desk research and bolstered it with continuous government consultation. This design was instrumental in understanding the intricate dynamics between various educational stakeholders and the implemented technological interventions.

Figure 7. *Research process*

3.2. Methodological approach

We supplemented qualitative data with desk research and employed the data collection methods listed below, to gather robust and nuanced data.

Key informant interviews

We interviewed 31 stakeholders comprising government officials, school-level stakeholders, and implementation partners.

Classroom observations

In addition to the interviews, we undertook classroom observations and engaged students in unrecorded conversations to ensure confidentiality and cultural sensitivity.

Desk research

We undertook initial desk research before our field visit to Gilgit-Baltistan. However, once the team was in Gilgit-Baltistan, we worked with stakeholders to identify and access available resources, including baseline reports produced by the Rupani Foundation and GBtechive and the request for proposal for each intervention. Desk research gathered information on relevant evidence about EdTech implementation in low-resource contexts that aligned with the themes that emerged from our qualitative data analysis.

3.3. Key informant interviews

EdTech Hub joined the study as a research partner during the later implementation phases. To collect qualitative data, the EdTech Hub team conducted key-informant interviews across all segments of stakeholders, i.e., government officials, school administrators, private implementation partners, teachers, Tech Fellows, and students. Among the many stakeholders involved in the STEAM and Smart Schools initiatives' vision, planning, procurement, and implementation, we engaged with the stakeholders listed in Table 2 below for data collection and consultations.

Table 2. *Key informant interviews*

Type of stakeholder	Number of interviewees	Details
Government officials	4	■ Additional Secretary ■ Two District Directors of Education (DDEs) ■ Deputy Director EMIS
School-level stakeholders	14	■ Principals ■ Teachers ■ Students
Private implementation partners	13	■ Tech Fellows ■ Personnel from Rupani Foundation ■ Personnel from Gilgit-Baltistan Techive (GBtechive)

3.4. Qualitative data analysis

Most of the data gathered in this study was qualitative, generated out of interviews with key stakeholders, including government officials, principals, teachers, and students. Following data collection, we analysed the data to identify themes and insights.

Recorded interviews and note-taking

During interviews, we focused on capturing the essence of stakeholders' experiences and perceptions. This method involved listening to each recorded interview multiple times, concentrating on elements such as content, tone, and emotion to ensure a comprehensive understanding of stakeholder perspectives.

Selective transcription

As the interviews were conducted in Urdu, transcribing whole interviews and translating them into English for analysis was beyond the research team's capacity. Recognising the extensive nature of qualitative data, we transcribed only the most pertinent sections of interviews. Post-interview, we composed detailed summaries, capturing the core insights, themes, and notable quotes, facilitating an efficient yet thorough data analysis.

Thematic analysis

Using thematic analysis, we identified patterns and themes in the qualitative data. This involved a systematic review and coding of data

segments, followed by aggregating related codes into overarching themes, which provided critical insights into the implementation challenges, successes, and perceptions of EdTech interventions in Gilgit-Baltistan.

Anonymisation

Besides anonymising the selected interview transcripts, the ranks, titles, and identifiers were anonymised in the report to ensure complete confidentiality and protection of the individuals who participated in the interviews.

3.5. Limitations

While this study provides valuable insights, it has its limitations. Although the research methodologies selected were implemented to temper the impact of limitations, the qualitative nature of the data and the limited sample size inevitably contribute to the study's limitations.

Methodology

Combining qualitative data collected by EdTech Hub with programme documents provided by the government and its implementation partners, means that the views and experiences of a small sample shape this report.

Data collection

Data for this study was collected in August 2023, in the middle of the STEAM programme and two months before the end of the Smart Schools programme. Since then, further EdTech interventions (including the Smart Classrooms programme) have been implemented in Gilgit-Baltistan.

Sampling bias

The selection of participants for qualitative data collection could introduce bias, as specific demographics or geographic regions may be overrepresented or underrepresented. This bias may affect the generalisability of the findings to the broader population impacted by the EdTech interventions.

Long-term impact

The study is limited in assessing the long-term impact of the EdTech interventions, as the study period ended relatively soon after the programme's conclusion. This limitation may restrict the understanding of sustained benefits or drawbacks over time.

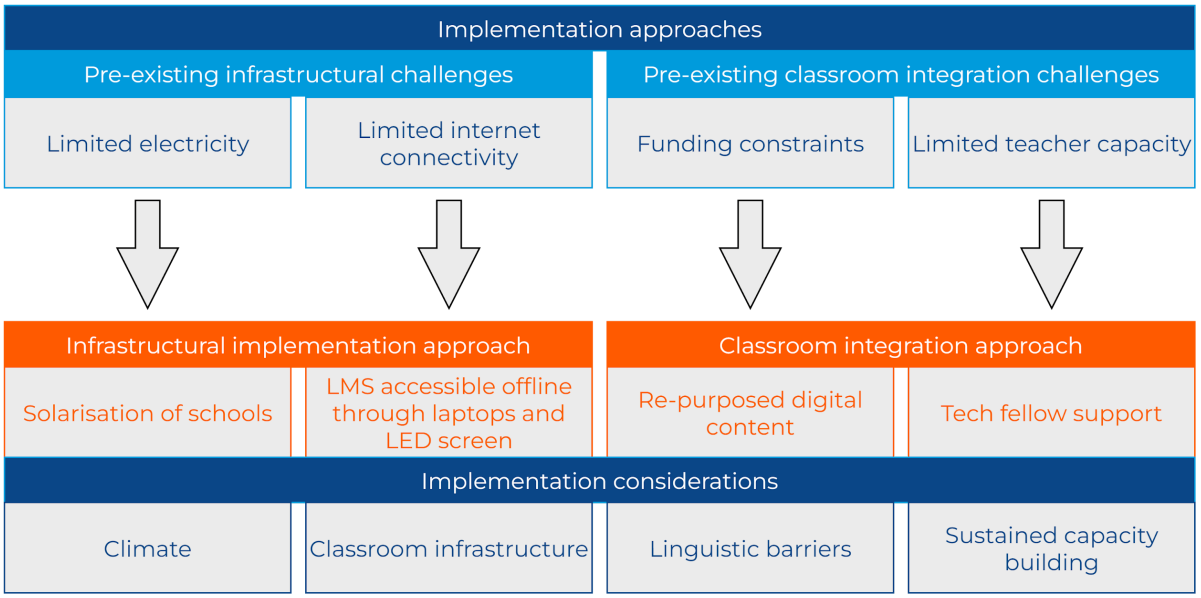
4. Discussion

This section aims to identify and analyse the challenges and opportunities related to implementing the Smart Schools and STEAM interventions. During interviews, stakeholders did not specify which intervention they were referring to and instead focused on their experience as a whole. As a result, we do not differentiate between the two interventions but reflect on overarching themes that cut across EdTech implementation in Gilgit-Baltistan. The analysis indicates the stakeholders' perspectives of government approaches to infrastructural integration, classroom integration, implementation partnerships and processes, and opportunities for sustaining interventions.

4.1 Solution integration

This section explores perspectives gained through stakeholder interviews on solution integration and implementation. These perspectives reflect on the infrastructural aspects of implementation and classroom integration. When discussing their experiences, stakeholders referenced key opportunities that need consideration to enhance the intervention.

Figure 8. *Infrastructural and classroom integration*



4.1.1. Infrastructural integration

The STEAM and Smart Schools interventions approach digital infrastructure in contrasting ways. While the STEAM intervention required schools to have pre-existing access to electricity and internet connectivity, the Smart Schools intervention was designed with such infrastructural challenges in

mind. When discussing infrastructural integration, stakeholders primarily referred to the Smart Schools intervention.

Electricity

When discussing challenges relating to electricity supply, stakeholders referred to the government's solarisation approach. The Government of Gilgit-Baltistan has invested heavily in testing EdTech implementations that leverage solarisation. Stakeholders consider implementing solar energy solutions in schools a proactive measure, which addresses the difficulties with electricity supply while also promoting sustainable and long-term access to digital learning. Principals and school administrators highlight solarisation as a key initiative, ensuring a consistent power supply and fewer or no disruptions to schooling.

However, it is essential to note that solarisation does not mean schools have full access to electricity. In one school, the informant noted:

> *"Only the lab is solarised, and we were told not to divert electricity to any other class from there."* (Key Informant Interview, August 2023)

Teachers also reported that because the area lacks general access to electricity, school staff sometimes use the solar output for personal reasons.

Internet and connectivity

According to the stakeholders we interviewed, even where the internet is available in Gilgit-Baltistan, the bandwidth is very low:

> *"Electricity and the internet are our biggest issues. Even when we have internet, the bandwidth is really low."* (Key Informant Interview, August 2023)

By aligning the design of Smart Schools with an understanding of infrastructural needs, the Government of Gilgit-Baltistan has introduced an offline solution that is accessible even in very low-resource schools that lack internet connectivity.

> *"So, LMS with preloaded content was a great solution, as students could rewatch it* [a video] *without interruption."* (Key Informant Interview, August 2023)

Classroom infrastructural considerations

While stakeholders spoke highly of the infrastructural aspects that the EdTech interventions sought to address, principals, District Directors of Education (DDEs), and private stakeholders alike raised concerns about a shortage of classrooms.

> *"We were told to give two separate rooms. We have a shortage of classrooms and we had a lot of problems. We have a lot of sections, and we had to make kids sit on a baramda [porch] outside to manage."* (Key Informant Interview, August 2023)

4.1.2. Classroom integration

While alignment with infrastructural realities is critical for any EdTech intervention, prioritising measures to ensure effective teaching and learning determines an intervention's impact on learning outcomes. In this section, we discuss stakeholders' perceptions around teacher capacity building, learner and parent engagement, and the quality of educational content.

Teacher capacity building

Stakeholders referred to limited teacher capacity generally, and teacher digital skills specifically, as critical challenges in implementing EdTech:

> *"We made labs in schools, but we don't have enough tech-savvy people."* (Key Informant Interview, August 2023)

School principals voiced concerns about how teachers in Gilgit-Baltistan struggle with managing large class sizes that are not conducive to learning. Scheduling classes that rely on content from the learning management system (LMS) can overburden teachers due to the complexity of scheduling with varying class sizes and teachers teaching multiple grades and sections. While principals acknowledged that Tech Fellows provide significant support to teachers, some stakeholders nonetheless expressed concerns that this intervention needs to lead to sustained improvements in teacher capacity.

> *"Teachers have not been trained in tech. The Tech Fellows are the ones operating the technologies in the classrooms."* (Key Informant Interview, August 2023).

Furthermore, according to principals, teachers, and Tech Fellows alike, there was limited information about how long Tech Fellows would be employed for, and this contributed to a sense of uncertainty. Some stakeholders believed this could compromise the quality of Tech Fellows' contributions.

They felt that offering tech fellows permanent positions would help ensure continuous support to teachers.

Learner and parent engagement

According to stakeholders, Gilgit-Baltistan's EdTech interventions have significantly fostered trust and credibility within the community. At the school level, administrators feel that positive parental involvement in education has surged, pointing to a shift towards increased local engagement and support. Students are also perceived to be motivated by integrating technology in classrooms. This drives the adoption of innovative learning tools like videos and LMS labs that provide easy access to educational content, facilitating concept visualisation and active learning. Interviews revealed that this has led to a conducive learning environment and increased enrolment in STEAM programmes.

Relatable and quality educational content

Stakeholders spoke about opportunities for further enhancing existing approaches, particularly about digital content. Since creating new content requires significant resources, the government utilised pre-existing content aligned with the Federal curriculum for the LMS content. While this approach may have helped to conserve scarce resources, stakeholders at the school level, however, reported linguistic barriers to engaging with the digital content. Notably, they felt that technical terms in Urdu were more difficult for students and teachers to comprehend. Teachers felt that students were, in fact, more familiar with some English terms due to their prevalence in existing textbooks.

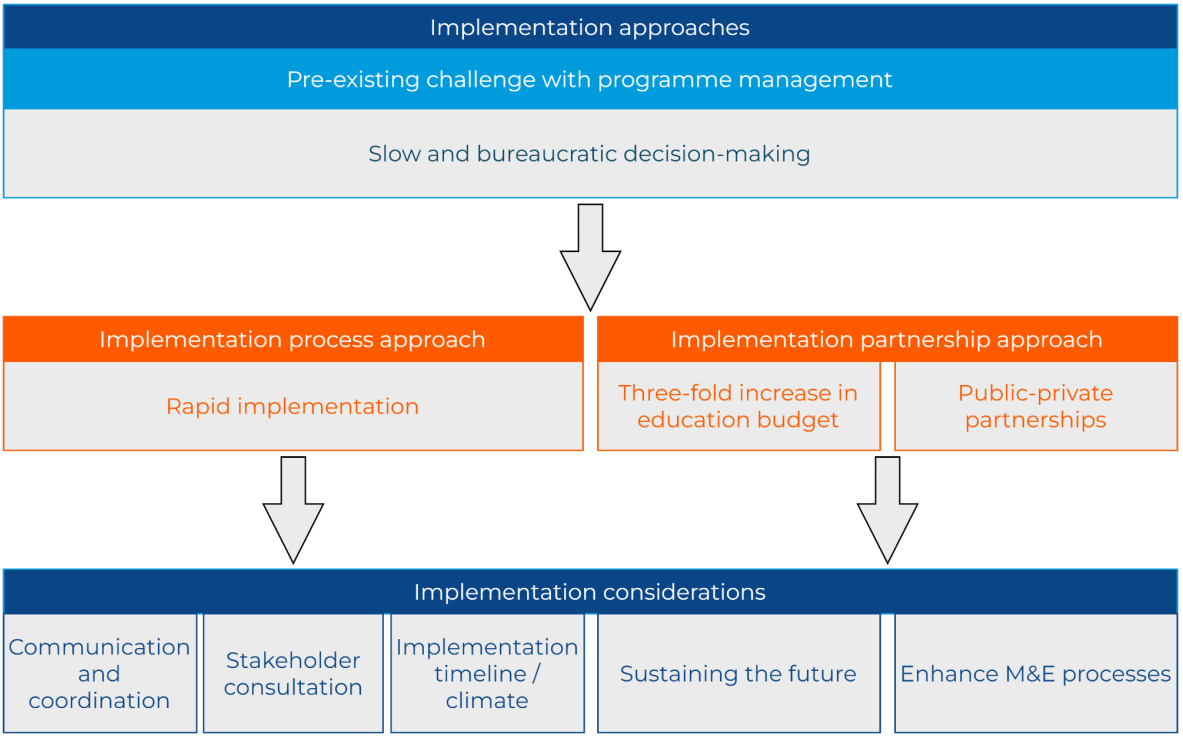
Furthermore, stakeholders emphasised that more localised content would resonate better with students. According to one principal, a lack of localised content impedes students' ability to bridge theoretical knowledge with practical applications that can improve student engagement. Some relatively tech-proficient teachers also asked to add their own videos and content to the LMS. Such a step would empower teachers to create their own instructional content and provide bespoke content that is considered necessary for the students.

4.2 Programme management

According to stakeholders, the government's political will has led to rapid implementation that has garnered the trust of communities. At the same time, interviews revealed that improvements in communication and

coordination and efforts to consider the impact of weather conditions could bolster existing approaches.

Figure 9. *Programme management*



4.2.1. Implementation partnerships and processes

The government chose to engage private partners to implement these interventions quickly and efficiently, providing particular lessons about coordination during the design phases of interventions.

Communication and coordination

Stakeholders reported a noticeable disconnect persists between decision-makers and actors involved in implementation, with District Directors of Education (DDEs) and managers frequently excluded from crucial information loops. Communication gaps also occurred at the school level.

> *"We weren't told how many Tech Fellows were coming, what their MoUs were, what their job description was."* (Key Informant Interview, August 2023)

The interviews highlight that communication gaps exist at various levels of decision-making. For example, one stakeholder felt that the need for more

streamlined coordination between stakeholders and government departments hinders the continuous progress of the interventions.

Design and implementation timeline

While the Government of Gilgit-Baltistan's solid political will leads to rapid implementation that yields positive perceptions of the communities it serves, key stakeholders at the design stage of the programme must be consulted by leveraging their expertise and ensuring alignment.

> *"DDEs should be taken into the loop right from the centre as they supervise the schools and can directly support the school with anything they need, and we have a different level of ownership."* (Key Informant Interview, August 2023)

Additionally, there are opportunities to enhance the timing of rapid implementation. At present, the speed of implementation does not leave enough time to conduct needs assessments.

> *"When the order came from the leadership that they wanted this number of classrooms, we did not have time to do the proper needs analysis, and we had to fulfil the request despite having an inadequate number of classrooms."* (Key Informant Interview, August 2023)

Further, as a mountainous region, Gilgit-Baltistan's climate has several implications for implementing its initiatives, particularly in winter, affecting the timing. Stakeholders referred to winter challenges during hardware provision and installation.

Hardware provision and installation are complicated during winter, when parts of Gilgit-Baltistan become more challenging to reach due to landslides and snowfall. Even where interventions do not require technology, stakeholders mentioned how Gilgit-Baltistan's challenging terrain poses accessibility issues, particularly for NGOs engaged in educational outreach efforts, hindering their ability to effectively reach marginalised and remote communities. They suggest considering the impact of seasonal weather conditions when developing implementation timelines for any initiatives.

> *"Weather conditions are an issue here. Implementation should have been done earlier, rather than in January."* (Key Informant Interview, August 2023)

4.2.2. Sustaining partnerships

While stakeholders spoke highly of the government's momentum and political will, with one stating in an interview in August 2023 that "There is no doubt about the will. The government is very motivated", some expressed concerns about sustaining partnerships. According to stakeholders, the Government of Gilgit-Baltistan temporarily tripled the education budget to invest in several programmes. Some felt it was uncertain how long the increased budget was sustainable.

Other stakeholders expressed concern that relying on variable political support and external funding creates instability and uncertainty for project implementation. Stakeholder interviews suggest that the fluctuating availability of external funds and the crucial role of political figures in securing these funds underscore the necessity for Gilgit-Baltistan to develop long-term and sustainable EdTech interventions.

> *"We need consistency. We need a system that would still work after the NGOs withdraw after one year."* (Key Informant Interview, August 2023).

5. Considerations and recommendations

Stakeholders' perceptions about EdTech implementation in Gilgit-Baltistan raise several considerations that can inform good practices globally, and opportunities to enhance EdTech implementation within Gilgit-Baltistan itself. Gathering the perspectives of teachers and DDOs in particular, helps shape nuanced findings around solution integration and programme management. In terms of solutions alone, there is much to learn from Gilgit-Baltistan's approach of developing solutions that align with infrastructural needs. The Smart Schools LMS is available offline, and significant investments in school solarisation have been made. There are opportunities to enhance programme management, which stakeholders expect will lead to better classroom integration and sustained impact.

The government's rapid implementation approach through a high level of political will is perceived to have garnered the trust of communities and, according to government stakeholders, is expected to increase enrolments in government schools. However, there are opportunities to invest in programme coordination and communication strategies that could help improve aspects of classroom integration. One example is teachers' requests for more clarity regarding the number of external personnel likely to support implementation and their roles. Furthermore, key stakeholders at the school level, in the private sector, and in the government itself are aware of potential difficulties maintaining EdTech initiatives over time (this is not uncommon with EdTech implementations in LMICs; see Figure 9). Support personnel could help catalyse lasting change in teaching practices.

Based on our discussion of findings, the following recommendations cover key considerations of infrastructure and capacity alignment and programme implementation and evaluation. Each recommendation presents the relevant lessons learnt in this study and the opportunities they offer.

5.1. Infrastructural alignment

The following considerations regarding contextual infrastructural alignment present opportunities to enhance the EdTech implementation processes in Gilgit-Baltistan. While the research focused on specific EdTech implementations in Gilgit-Baltistan, the findings may well have value for enhancing and implementing EdTech solutions in low-resource and remote contexts around the world.

1. Local learning hotspots

Teachers in Gilgit-Baltistan value local learning hotspots. EdTech implementers globally could learn from this and design EdTech interventions that align with schools' infrastructural needs.

Lesson: In the *Smart Schools* intervention, the government prioritised solarisation to address challenges with electricity supply and made content available offline to mitigate issues with connectivity. The teachers we interviewed in Gilgit-Baltistan valued this approach. They noted that even where the internet is available in Gilgit-Baltistan, it is patchy and can only support a couple of laptops.

Opportunity: Making content available offline through local learning hotspots can reduce teacher frustrations that impact implementation and can, therefore, be explored in low-resource settings in Pakistan and globally.

2. Prioritise conducting a needs assessments

Needs assessments should include data beyond digital infrastructure availability. Understanding school-level infrastructure, including the number of available classrooms, is critical to EdTech implementation.

Lesson: According to stakeholders, directives from senior officials led to a rapid implementation process, leaving little time to conduct a thorough needs assessment. One result was that EdTech was perceived to have placed a burden on schools with limited classrooms. Across many low-resource settings, short implementation timeframes make conducting a needs assessment difficult.

Opportunity: To overcome this, we recommend that District Directors of Education (DDEs) maintain an up-to-date database of school-level infrastructure across the schools in their network. This data could help inform the design phase of interventions.

3. Consider the impact of weather conditions

Winter months impact solar energy reliability. Explore investments in weather-resilient solarisation efforts, such as solar panels without frames or power storage tools like battery packs.

Lesson: While investing in solarisation is a strategic investment that reflects a commitment to climate resilience and environmental sustainability, according to stakeholders, Gilgit-Baltistan's winter months lead to a shortage of solar energy, impacting EdTech use.

Opportunity: To address this challenge, stakeholders could explore a range of options, including:

1. Exploring solarisation efforts that are more resilient to cold weather conditions, such as solar panels without frames (↑Gray, 2017) and systems that deploy power storage tools like batteries.
2. Scheduling EdTech programmes in Gilgit-Baltistan in the spring, summer, and autumn rather than in the winter.

5.2. Capacity alignment

This section explores how EdTech interventions should be complemented and bolstered by capacity-building components in their designs. These recommendations aim to improve classroom integration of the interventions.

1. Invest in support personnel

Investing in support personnel like Tech Fellows can support classroom integration. For a sustained impact on teacher professional development, teachers should be incentivised to learn from the support provided.

Lesson: Support personnel can provide teachers lacking digital skills with the opportunity to facilitate blended learning in their classrooms. However, teachers must learn from the support personnel to sustain capacity growth rather than rely on them.

Opportunity: Support personnel should be trained on pedagogy so they can work with teachers to enhance their pedagogical approaches and digital skills. One way to approach sustained capacity growth is to get support personnel to train a champion teacher in each school.

2. Test available content with local communities to ensure cultural relevance

If available content is repurposed, consider developing a glossary that translates technical terms to help overcome linguistic barriers.

Lesson: While Urdu and English are Pakistan's official languages, students across the country speak several regional languages. The Government of Gilgit-Baltistan has repurposed available learning content — a sustainable investment. However, teachers have referred to challenges with students understanding technical Urdu phrases due to their familiarity with English terms from the textbook.

Opportunity: Enthusiastic teachers with digital literacy can be engaged to add their own instructional content to the LMS and its instructional content library. Support personnel can work with teachers to contribute to content development.

3. Use lesson plans

Consider including lesson plans on the LMS to support teachers throughout the programme.

Lesson: Teachers felt that the curated content on the LMS allowed them to save valuable class time.

Opportunity: Some teachers felt that lesson plans on the LMS could be helpful.

5.3. Programme management and evaluation

1. Enhance communication with school-level actors

Enhance communication across key implementing actors, with a priority at the school-level.

Lesson: A noticeable disconnect persists between decision-makers and actors involved in implementation, with District Directors of Education (DDEs) and school-level actors frequently excluded from crucial information loops.

Opportunity: Providing DDEs and school heads with clear guidance about the EdTech implementation strategy will help key actors prepare their schools for programme implementation.

2. Consider piloting programmes before scaling

Consider implementing pilot programmes before rolling out large-scale interventions and documenting successful programmes.

Lesson: Pilot programmes can help test the effectiveness of different approaches and identify potential challenges, thus allowing for adjustments based on actual needs before full implementation.

Opportunity: The Smart Schools intervention could be considered the equivalent of a pilot with the potential for further growth. Lessons learnt through this pilot should be used to inform the design of future EdTech implementation, providing school-level actors with an opportunity to contribute their experiences. Additionally, documenting successful interventions and developing models that can be replicated and scaled up in other schools and districts can prevent organisations from taking

fragmented approaches and having to reinvent the wheel with each programme — leading to financial savings.

3. Align data collection and monitoring with decision-making

Ensure that data collection and monitoring systems feed into the decision-making process.

Lesson: Data integration can offer ongoing insights into school and student needs, helping to tailor interventions effectively. Regular assessments and feedback mechanisms can inform the continuous improvement of educational programmes.

Opportunity: Although the Smart Schools programme's current dashboard provides real-time data on usage patterns, it could benefit from integration with Gilgit-Baltistan's EMIS dashboard. The consolidated data could be leveraged to understand benefits and areas requiring further improvement.

Bibliography

This bibliography is available digitally in our evidence library at https://docs.edtechhub.org/lib/VHFR6UIT

ASER Pakistan. (2024). *Annual Status of Education Report ASER-Pakistan 2023: National (Rural)*. https://aserpakistan.org/document/2024/aser_national_2023.pdf. (details)

Adil, F., Nazir, R., & Akhtar, M. (2021). *Investigating the Impact on Learning Outcomes Through the Use of EdTech During Covid-19: Evidence from an RCT in the Punjab province of Pakistan* (Working Paper No. 41). EdTech Hub. https://doi.org/10.53832/edtechhub.0067. Available from https://docs.edtechhub.org/lib/FSVST5BF. Available under Creative Commons Attribution 4.0 International. (details)

Aga Khan University. (2023). *AKU, Gilgit-Baltistan govt partner to boost teacher capacity | The Aga Khan University News*. https://www.aku.edu/news/Pages/News_Details.aspx?nid=NEWS-003050. (details)

Aziz, B. (2024, February). *Introduction to Gilgit-Baltistan: Geographical, Cultural, and Historical overview — North Times*. https://www.northtimes.org/gilgit-baltistan-geographical-cultural-historical/. (details)

Cavanaugh, C., & DeWeese, A. (2020). Understanding the professional learning and support needs of educators during the initial weeks of pandemic school closures through search terms and content use. *Journal of Technology and Teacher Education*, *28*(2), 233–238. (details)

D'Angelo, S., Barón, J., Mazari, H., Morales, D., Tabares, S. O., Santos, P. P., & Kaye, T. (2024). *Lessons on Scalability Implementing Digital Personalized Learning in Public Schools*. World Bank. (details)

DAWN News. (2023). *Gilgit-Baltistan sees threefold rise in funds for education sector: Chief secretary*. DAWN.COM. https://www.dawn.com/news/1731855. (details)

Education Department of Gilgit-Baltistan. (2014). *Gilgit-Baltistan Education Strategy 2015–2030*. https://planipolis.iiep.unesco.org/sites/default/files/ressources/pakistan_gilgit-baltistan-education-strategy-2015-30.pdf. (details)

Ferede, B., Elen, J., Petegem, W. V., Hunde, A. B., & Goeman, K. (2022). A structural equation model for determinants of instructors' educational ICT use in higher education in developing countries: Evidence from Ethiopia. *Computers & Education*, *188*, 104566. https://doi.org/10.1016/j.compedu.2022.104566. Available from https://www.sciencedirect.com/science/article/pii/S0360131522001373. (details)

Government of Gilgit-Baltistan, & UNICEF. (2017). *Gilgit-Baltistan: Multiple Indicator Cluster Survey 2016–2017*. (details)

Gray, C. (2017). *Let it Snow: How Solar Panels Can Thrive in Winter Weather*. Energy.Gov. https://www.energy.gov/eere/articles/let-it-snow-how-solar-panels-can-thrive-winter-weather. (details)

Hennessy, S., D'Angelo, S., McIntyre, N., Koomar, S., Kreimeia, A., Cao, L., Brugha, M., & Zubairi, A. (2021). *Technology, Teacher Professional Development and Low- and Middle-Income Countries: Technical report on systematic mapping review* [Technical Report]. EdTech Hub. https://doi.org/10.53832/edtechhub.0047. Available from https://docs.edtechhub.org/lib/VTQDT65R. Available under Creative Commons Attribution 4.0 International. (details)

Jamil, B. (2023). *Walking the Talk for the Right to Education — A field note on Gilgit Baltistan and its Delivery Lab*. https://educationcommission.org/updates/walking-the-talk-for-the-right-to-education-a-field-note-on-gilgit-baltistan-and-its-delivery-lab/. (details)

Sun King. (2024). *BEFIT and Sun King roll out solar tech to primary schools in Malawi*. Sun King. https://sunking.com/solar-news/befit-set-to-roll-out-solar-powered-edtech-to-all-primary-schools-in-malawi-by-2029-2/. (details)

Upadhyay, A., Shoobridge, J., & Moss Coflan, C. (2020). *Effective Use of EdTech for Remedial Learning Programmes: Considerations for Mongolia* (Helpdesk Response No. 27). EdTech Hub. https://doi.org/10.5281/zenodo.5651111. Available from https://docs.edtechhub.org/lib/IJGQTHH9. (details)

Wilson, S., Khalayleh, A., Baloch, I., & Kaye, T. (2022). *Desk Review of Technology-Facilitated Learning in Pakistan: A review to guide future development of the technology-facilitated learning space in Pakistan* [Evidence Review]. EdTech Hub. https://doi.org/10.53832/edtechhub.0071. Available from

https://docs.edtechhub.org/lib/6FN5VTP7. Available under Creative Commons Attribution 4.0 International. (details)

Zubairi, A., Khalayleh, A., Baloch, I., Mazari, H., Kaye, T., & Groeneveld, C. (2022). *Pakistan Digital Learning Landscape Analysis* [Technical Report]. EdTech Hub. https://doi.org/10.53832/edtechhub.0093. Available from https://docs.edtechhub.org/lib/HEXCEXFK. Available under Creative Commons Attribution 4.0 International. (details)