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HELPDESK RESPONSE 37

EdTech That Reaches Marginalised Learners: Relevant Examples for the Indonesian Context

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Notes

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About the EdTech Hub Helpdesk

The Helpdesk is the Hub's rapid response service, available to FCDO advisers, UNICEF Country Offices, and World Bank staff in 70 low- and lower-middle-income countries (LMICs). It delivers just-in-time services to support education technology planning and decision-making. We respond to most requests in 1–15 business days. Given the rapid nature of requests, we aim to produce comprehensive and evidence-based quality outputs while acknowledging that our work is by no means exhaustive. For more information, please visit https://edtechhub.org/helpdesk/.

Contents

Tables

Abbreviations and acronyms

ARM	Accessible Reading Materials
DAISY	Digital Accessible Information System
DTV	Digital Television
EDGE	English and Digital for Girls' Education
FCDO	Foreign, Commonwealth and Development Office
FESF	The Family Education Services Foundation
GEC	Girls Education Challenge
ICT	Information Communication Technology
IRI	Interactive radio instruction
IVRS	Interactive Voice Response System
JICA	Japan International Cooperation Agency
LCFA	Learning Competency Framework and Approach
LMIC	Low- and middle-income country
MoECRT	Ministry of Education and Culture and Technology
PEAS	Promoting Equality in African Schools
RCT	Randomised controlled trial
RTM	Radio Televisyen Malaysia
SD	Secure digital
SEND	Special Education Needs and Disability
SMS	Short message service
STEM	Science, Technology, Engineering, Mathematics
TAI	Television-assisted instruction

1. Purpose and goals of the request

Although children in Indonesia have a better chance of being in school than ever before, 4.3 million children and adolescents in Indonesia are, at the time of writing, out of school. Children and youth living in remote and underdeveloped regions of the country are most at risk of not attending school. To address this challenge, the Government of Indonesia, with support from UNICEF, has sought to improve access to and quality of education for the most marginalised children by exploring the use of EdTech as a means to reach them. This curated list presents EdTech interventions that effectively reach marginalised learners, including children with disabilities and girls, in the frontier, outermost, and disadvantaged (3T) regions of Indonesia.[1] The goal of this work is to provide relevant examples that will help the UNICEF Indonesia Country Office and partners identify potential means of reaching marginalised learners. We have focused on curating examples from Asia and low- and and middle-income countries (LMICs) as far as possible. This document may be shared with the UNICEF Indonesia Chief of Education and potentially with government partners.

Based on discussion with the UNICEF Indonesia Country Office, the EdTech Hub Helpdesk team has focused on the following categories in curating examples:

- Groups of marginalised learners, including girls, children with disabilities, and those living in the '3T' regions.
- EdTech modalities that work with limited or inconsistent connectivity, including offline platforms, broadcast media (TV and radio), SMS, and paper-based materials.

This brief begins with a short overview of the ICT infrastructure in Indonesia. It is followed by distinct sections that summarise effective use of EdTech to reach

1. Marginalised learners
2. Children and youth in 3T areas
3. Children with SEND
4. Girls

[1] In Bahasa, *terdepan*, *terluar*, and *tertinggal,* or '3T' for short, are often used to describe the frontier, outermost, and disadvantaged regions of Indonesia.

2. ICT Infrastructure and EdTech in Indonesia

In Indonesia, the Covid-19 pandemic and related school closures across the country have forced nearly 68 million students into distance learning. While digital innovations and investments have been brought forward, inequity in education continues to rise. With Indonesia's fragmented archipelago landscape, there are vast disparities in internet penetration and connectivity across regions. About 61 million Indonesians do not have internet connectivity in low-income and remote rural areas. According to Indonesia's Central Statistics Agency, only 21% of people in low-income areas have access to the internet, in contrast with the 93% in high-income areas such as Java. Remote islands remain unreached, and many students and teachers do not have access to the devices, connectivity, or skills required for digital learning. In 2020, 67% of teachers reported difficulties in operating devices using online learning platforms. Of school-age girls, 68% study only two hours or less a day when learning from home. Children with disabilities are particularly disadvantaged, as many have not been able to access the services required for their personalised learning needs.

The Government of Indonesia has partnered with nonprofits and EdTech companies to provide access to digital learning for teachers and students. The Ministry of Religious Affairs and the Ministry of Education and Culture and Technology (MoECRT) are using online learning platforms for teacher training and support. The MoECRT has promoted both online and offline initiatives to support digital learning. These initiatives include e-modules catering to the national curriculum through programmes like ↑Gerbang Kurikulum (2021), educational TV programming such as ↑TVEdukasi (2022), and distance learning programmes like ↑Belajar dari Rumah (2020). To date, uptake of EdTech platforms seems to be limited to urban users in major islands (↑UNICEF, 2021). Low-tech digital solutions hold great promise in bridging the gap. In contrast to the uneven distribution of internet connectivity, most people in Indonesia have access to radio, and 95% have access to television. It is important to explore EdTech solutions that are more accessible for the most disadvantaged, marginalised learners.

3. EdTech interventions that reach marginalised learners

In 2020, EdTech Hub developed a series of publications on the use and outcome of different EdTech interventions for marginalised groups, including girls, learners living with disabilities, and out-of-school learners. Key findings include the following:

- Evidence shows that using low-tech solutions, such as radio, television, messaging, and tech-enabled personalised learning can help support learning outcomes for rural, hard-to-reach, and out-of-school learners.
- Assistive devices have the potential to improve educational access for learners with special educational needs.
- When barriers are removed — and female learners are given better access to technology — girls are likely to respond with a higher level of engagement. Technology has been found to be disproportionately more empowering for girls than boys.
- Mixed modalities (use of multiple devices within an approach) are often used to improve reach and enhance interactivity of distance learning programmes.
- 'No-tech' approaches are an important and viable option, considering access to electricity and connectivity remains limited in extremely remote areas.

In the following section, we provide examples of EdTech interventions that effectively reach marginalised learners. We start with interventions that reach children in the '3Ts' (frontier, outermost, and disadvantaged children), followed by children with disabilities, and then girls.

4. EdTech interventions targeted to children in frontier, outermost, and disadvantaged regions

In countries with limited infrastructure for internet-assisted instruction and relatively large populations of marginalised learners, low-tech solutions such as interactive radio instruction (IRI) and television-assisted instruction (TAI) are commonly implemented.

4.1. Radio

Educational radio programmes have often been used to reach less-populated areas and rural learners. Following a review of 15 projects, Ho, Thukral, and Laflin found that IRI helped bridge urban–rural achievement gaps in mathematics and English (↑Ho et al., 2009). Educational radio was found to improve student learning outcomes in mathematics, literacy, and social studies when combined with printed learning materials and interactive activities. Evidence shows that IRI can enable marginalised groups in low- and middle-income countries to achieve better academic results. In another study, ↑Nekatibeb & Tilson (2004) described how IRI increased learning gains equally in urban and rural Ethiopian primary schools. ↑Cheung (2012) also demonstrated the utility of radio in increasing children's primary school attendance in rural Cambodia. IRI has also been used in response to school closures caused by the Covid-19 pandemic and is frequently used in fragile and conflict-affected settings to reach marginalised and disadvantaged learners. For more information on what makes for effective radio programming, please refer to EdTech Hub's curated list on interactive radio instruction (↑McBurnie, 2020), a rapid evidence review of radio (↑Damani & Mitchell, 2020), a guide on delivering quality radio learning (↑Rising Academies & EdTech Hub, 2021) and the UNICEF / World Bank resource pack on radio (↑UNICEF & World Bank, 2022c). Table 1 below presents a selection of EdTech programmes that have used radio as a means to reach marginalised learners.

Table 1. *Relevant examples of educational radio programmes*

Programme	Description
Supplementary radio programmes in Fiji	In response to school closures due to Covid-19, Fiji introduced a supplementary educational radio programme that targeted out-of-school children. Daily lessons that covered literacy and numeracy for Grades 1–8 as well as early childhood education, were broadcast through the Schools Broadcasting Unit and Fiji Broadcasting Corporation on two radio channels. The radio programme was designed to accompany digital exercise books / workbooks (↑Ministry of Education, Heritage & Arts, 2020).
Broad Class — Pakistan	Broad Class uses IRI as a classroom tool to guide teachers and students through activities, games, and exercises. The programme targets marginalised children in extremely remote areas through daily 45-minute lessons approved by the Federal Provincial and District Education Departments. Special wooden radios are locally designed and provided to classrooms, with rechargeable dry batteries and USB / memory card options. The programme currently reaches 200,000 children, teachers, and parents (↑Lister, 2019).
Edutainment: gender-related radio in Cambodia	The popular radio station 'Women's Radio FM 102' in Cambodia is using an 'edutainment' approach to broadcast programmes that educate and inform Cambodians on women's rights and health issues, including domestic violence, HIV / AIDS awareness and poverty alleviation. The radio programme is free to access in the country and available even in rural areas. Studies have shown that exposure to the radio programme has positively affected gender-related attitudes and increased children's school enrollment (↑Cheung, 2012).
Rising on Air programme in Sierra Leone, Libya, and Ghana.	Designed by Rising Academy Network, the Rising on Air programme delivers radio content covering literacy, language, arts, and numeracy at five different levels across K-12, from early childhood education to senior secondary school, along with health and safety messages. In 2020, work with more than 171 schools in Liberia, Sierra Leone, and Ghana reached more than 900 teachers and 40,000 students across Grades Pre-K–12 (↑Lamba & Reimers, 2020).
The Somali Interactive	This programme was designed to improve reading, maths, and life skills for Somali children. Each 30-minute

Radio Instruction Programme	radio programme is made up of a series of activities, songs, poems, plays, and interviews that address the day's learning objectives. Wind-up and solar-powered radios are used where power sources and batteries are not available. By using IRI and an extensive network of local training and monitoring partners, the programme reached 330,000 children and youth over five years, 40,000 of whom were out of school, displaced, or marginalised (↑EDC & USAID, 2011).

4.2. Television

A rapid evidence review conducted by EdTech Hub found that in most LMICs, broadcast technologies like television reach larger audiences than internet-based EdTech (↑Watson & McIntyre, 2020). The review suggests that appropriate television-based interventions can improve learning outcomes in a cost-effective manner. Educational material delivered via videos played in schools that are supported by corresponding teacher guidance or broadcast through public channels offers a meaningful and effective alternative in environments where access to formal education is limited. Table 2 below presents a curated list of television-based EdTech programmes from Asia.

Table 2. *Relevant examples of educational TV programmes*

Programme	Description
Think! Think! Cambodia	Think! Think! is an education programme that provides free online lessons to young students. The Ministry of Education, Youth and Sport in cooperation with the Japan International Cooperation Agency (JICA), aims to broadcast educational TV programming via Satellite Digital TV (DTV) to reach students with no access to the internet or related devices. The programme will support learning for students in kindergarten, primary, and secondary school. Students can also access this content on demand via different digital platforms, including the Ministry of Education's mobile app, YouTube channel (↑Ministry of Education, Youth and Sport Cambodia, no date), and Facebook page as well as eLearning Centres. Students can also download video lessons from ↑e-School Cambodia (no date) and Wiki School Apps (↑Ministry of Education, Youth and Sport, no date).
TV Okey Malaysia	TV Okey is a Malaysian educational television channel from the public broadcaster Radio Televisyen Malaysia

	(RTM). It was launched on 6 April 2020 to deliver educational television programmes to all students, especially those without internet access (↑Radio Televisyen Malaysia, 2022). The television and radio programmes are live-streamed for two hours a day on the RTM website, MyFreeview TV application, and the Astro and Astro NJOI television channels. EduwebTV, previously called TV Pendidikan (↑Eduweb, no date), the online learning platform of the Ministry of Education, also hosts on-demand content and digital textbooks for students across Pre-Kindergarten to secondary school (↑Radio Television Malaysia, 2020).
Sangsad+ EduSkills Bangladesh	Sangsad+EduSkills Bangladesh is an educational programme that broadcasts pre-recorded lessons through the state-run Sangsad Television network. The televised classes were based on the annual lesson plan and included regular homework assignments. Since March 2020, the programme has broadcast over 2,100 classes and has reached 13.6 million students (↑UNESCO, 2021).

4.3. Mobile phones for messaging and interactive voice response

Mobile phone ownership is becoming increasingly widespread and, in some areas, even overtaking TV or radio ownership (↑UNICEF & World Bank, 2022a). Simple mobile phone technology like SMS (short message service) and phone calls and applications like WhatsApp can create learning opportunities for the most marginalised communities.

A rapid evidence review conducted by EdTech Hub noted several examples of the use of SMS to provide learning opportunities to remote and rural learners (↑Jordan & Mitchell, 2020). The success of many mobile phone and SMS interventions is due in part to the familiarity of the technology. SMS is likely being used at highly localised levels by individual teachers, schools, and district officials as a means to facilitate the delivery and sharing of resources. The review also notes the effective use of messaging to reach refugee populations. Social media and personal messaging, which are often accessed on personal devices, can provide crucial information to marginalised populations.

It is important to note, however, that high mobile phone ownership does not necessarily mean high levels of equity. Within households, women and young

children may have less access to mobile phones than older men. According to ↑UNICEF and World Bank (2022a), mobile learning may reinforce existing inequalities since people's access to and use of mobile technology can vary with age, socio-economic status, language, gender, and urban or rural location. Additional information can be found through UNICEF and the World Bank's new knowledge packs on mobile distance and hybrid education systems (↑UNICEF & World Bank, 2022a). Table 3 below presents a curated list of EdTech initiatives that use mobile technology.

Table 3. *Relevant mobile-phone-based EdTech examples from Africa and Asia*

Programme	Description
Botswana	↑Angrist et al. (2020) conducted a preliminary study on the effects of mobile-based interventions on learning outcomes for learners in Botswana in the context of Covid-19 and minimising learning loss. The two-pronged intervention consisted of one-way weekly SMS messages containing numeracy problems and supplemental 15-minute phone calls with a facilitator to discuss the problems. The facilitators asked parents to put the call on speakerphone, enabling them to engage both learners and parents in learning. Early evidence indicated that the SMS text messages and phone calls were linked with learning gains of 0.16 to 0.29 standard deviations.
Kiwix, Middle East and Africa	Kiwix, in partnership with Orange Telecom, is providing zero-rated access (free data) to Wikipedia, the Wiktionary, and the Gutenberg library or Khan Academy in ten countries in the Middle East and Africa region. The free educational resources are compressed into unique content packages (ZIM files[2]) and accessed via smartphone through offline access from local Kiwix servers. Compressed educational materials can be shared through flash drives and microcards (↑HundrED, 2020).
Teach for Uganda	Teach for Uganda has started a programme where teachers chat with students via SMS. The programme collected phone numbers from parents, briefed them about the programme objectives and encouraged them to allow their children to have access to their phones for one hour from 2–3 pm. During that hour, students receive chat-based questions that they answer, and the teacher

[2] According to Wikipedia, the ZIM file format is an open file format that stores wiki content for offline usage (↑Wikipedia, 2022).

	provides corrections and suggestions in real-time (↑Teach For Uganda, 2022).
M-Shule	M-Shule delivers personalised learning solutions through SMS to reach offline or marginalised children across Africa. Students learn from lessons and activities at home with parents through messaging. M-Shule tracks and analyses student progress, which can be shared with schools or caregivers to help improve student performance. M-Shule has reached nearly 20,000 households across the African continent (↑M-Shule, 2022).
IGATE-T Zimbabwe	In Zimbabwe, IGATE-T has recruited around 100 'Learning Champions' who are literate, numerate, and willing to use their mobile phones to support others in their learning via WhatsApp. After being given a monthly data allowance, these 'Learning Champions' share activities sent to them on their mobile phones with children and caregivers. For those who do not have WhatsApp, the Learning Champions find other ways to share activities with children in their villages through informal learning circles or caregivers. Additionally, the Learning Champions conduct daily activities with children who live nearby — specifically supporting children who don't have literate parents to help them (↑Power, 2020).
Nepal	A low-cost phone call and SMS intervention was found to support learning in Nepal effectively. This trial included 3,700 households with children in public schools (Grades 3–5). It provides instructional support for foundational literacy and numeracy skills using mobile phones — a high-access and low-cost approach. Results show that active phone calls by teachers and NGO facilitators are highly effective and statistically significant at the 1% level. There were larger effects for students from the poorest and lowest parent literacy backgrounds, indicating the potential for bridging equity gaps (↑Radhakrishnan et al., 2021).

4.4. Interactive Voice Response Systems

Within the use of mobile technology, Interactive Voice Response Systems (IVRS) have been used to engage learners and parents with grade-specific learning content. IVRS typically involves learners or parents calling a toll-free number to access audio recordings that deliver content and prompts to assess learning. A randomised controlled trial (RCT) of an IVRS programme in San

Francisco found that Grade 2 students who used audiobooks outperformed the control group in reading comprehension, vocabulary, and reading motivation (↑Flynn et al., 2016). For youth and adults in Bangladesh, 42% of users demonstrated increased confidence in using English after listening to 3-minute audio lessons on BBC Janala (↑BBC, 2014), which reached 28 million listeners (80% of its users were from rural areas) and 7 million accessed it via a dial-in option through a feature phone (↑World Bank, 2020). To date, there is no clear evidence of the effects of IVRS-based interventions on young children.

According to the World Bank (↑World Bank, 2020), strategies like IVRS are a highly equitable option for large-scale mobile learning because:

1. It is operable offline on low bandwidth and is feature phone compatible.
2. It is more accessible than other solutions due to its ability to reach physically disabled, blind, and multilingual learners.

At the same time, the broader challenges related to mobile technology are applicable to IVRS. Access to mobile devices can vary widely, depending on gender, household income, urban or rural location, and many other factors. Connectivity and data costs can equally show huge variation, potentially exacerbating existing inequalities. More information on IVRS and other voice call technologies can be found in the Resource Pack to Support Mobile Learning (↑UNICEF & World Bank, 2022a) and the knowledge pack of Mobile Distance & Hybrid Education Solutions (↑World Bank, 2020). A selection of EdTech programmes that have used IVRS is presented in Table 4.

Table 4. *Relevant examples of IVRS use in LMICs*

Project	Description
Makhalidwe Athu	This project in Zambia uses SMS and IVRS to provide K-3 parents and students with learning material and activities at home. It aims to increase reading time at home for students and time spent with family members in reading activities. Parents and community members can dial an IVRS line to listen to the story of the week. Stories and discussion questions are also sent via SMS thrice a week (↑Makhalidwe Athu, no date). An impact evaluation found "positive impacts on the frequency with which children read on their own at home" (↑USAID, 2018, p. ix).
Mtabe	Mtabe is a platform for students in Grades 7–12 that provides learning materials aligned with Tanzania's national curriculum. It uses artificial intelligence and SMS

	to deliver instant content to over 15,000 students (↑Mtabe, no date).
Phoneshaaala, India	In India, Phoneshaala provides learning content for students from Grades 1–8. Children can call a toll-free number where an IVRS plays audio lessons. They can listen and learn free of cost. The audio recordings also provide prompts to guide children through activities.
Thinkzone	ThinkZone uses IVRS and SMS to deliver do-it-yourself learning activities to parents of Pre-Kindergarten children (↑ThinkZone, 2020). ThinkZone's mobile platform also provides offline technology with teaching activities for students. Parents can call a toll-free number that provides remote instructions for activities to be done with their children through automated voice calls. Additionally, trained community educators provide parents with support through bi-weekly, live phone calls (↑ThinkZone, no date).

4.5. Hardware applications and pre-loaded content

Establishing community servers and distributing hardware with pre-populated content can provide a solution to reaching remote communities without an internet connection. Computers (like Raspberry Pi) can be used to set up a local wireless server that allows individuals to connect to WiFi and access digital content. Community servers are ideal for remote locations as it removes the need to print resources and distribute them to areas without access to the internet. However, upfront costs to purchase and distribute hardware to rural communities are required as well as some training to use the hardware.

A UNICEF study found three promising initiatives that use pre-loaded content for use in hard-to-reach areas (↑Dreesen et al., 2020):

1. In Burundi, governments and other education actors are providing secure digital (SD) cards preloaded with audio content to families with mobile phones.
2. In Greece, UNICEF has collaborated with the Akelius foundation to deliver preloaded language learning content to refugees and migrants through tablets.

3. In Viet Nam, UNICEF has procured 'Pad and Puck' packages (tablets and WiFi) to help vulnerable groups continue learning and maintain peer-to-peer communication.

Although preloaded devices can facilitate access to learning for remote learners, it is important to note that the hardware is only as effective as the quality of its pre-loaded content. In addition, hardware and technology on their own, without support or training, do not raise learning outcomes (↑Naylor & Gorgen, 2020). There is no clear evidence regarding the impact of initiatives like free netbooks on improving academic achievement (↑Ganimian et al., 2020). A selection of promising EdTech initiatives that use hardware and pre-loaded content to reach marginalised learners is presented in Table 5 below.

Table 5. *A curated list of EdTech initiatives that use hardware and pre-loaded content to reach marginalised learners*

Programme	Description
Syafunda Digital Library, South Africa	Syafunda is a pre-loaded digital library that emits WiFi hotspots so that anyone in the vicinity with a mobile device can access and download the material without having to pay for internet access. The Syafunda library includes nearly 5-Terabytes of pre-loaded content for Grades 9–12 that focus on STEM subjects, digital skills, and financial literacy (↑Syafunda, 2021).
Hub Heroes in Uganda	In partnership with the non-profit organisation and Global X-prize winner, OneBillion, the company Hello World provided tablets to 100 mothers (the heroes) to use at home. The 100 tablets were preloaded with the 'onecourse' app that allows children with no formal education to teach themselves to read, write, and do maths. Each Hub Hero was responsible for supervising each of her children's time using the tablet and also for charging the device at the Hello Hub (a community space for discourse and charging devices). The weekly 'hub' meeting also allowed the heroes to share their experiences of helping children learn. On average, each Hub Hero has five children in her family. By putting a tablet in each household and giving the mother responsibility for the device, around 500 children had dedicated tablet time every day (↑Hello World, 2020).
e-Limu Kenya	eLimu provides robust tablets to community centres in refugee camps. They are preloaded tablets with Somali-language stories and writing activities to help

	young people who would not otherwise have access to mobile learning (↑eLimu, no date).
Open Learning Exchange	Open Learning Exchange provides access to a multimedia digital library by providing communities with low-cost tablets and Raspberry Pi servers. The hardware is powered by solar panels. Learners, using any device with a browser, can log into their personal dashboard with access to the digital library using Raspberry Pi servers. Open Learning Exchange has worked in various countries, including Cambodia, Nepal, Somalia, Turkey, Bulgaria, and Ghana (↑Open Learning Exchange, no date).
Smart TxtBks Philippines	Implemented in the Philippines, Smart TxtBks converts old SIM cards into 'textbooks' which students can access, even offline, using simple feature phones. Smart TxtBks is ideal for delivering 'bite-size' (160 characters) learning content that can be stored in the phone's SIM cards and retrieved as messages (↑Smart TXTBKS, no date).

4.6. No-tech approaches

Effective policy for reaching marginalised communities should be based on a thorough understanding of the technology capacity of the existing system and target population. Considering that access to electricity and connectivity remains limited in many rural or remote settings, a no-tech approach to reaching extremely remote and marginalised communities may be the most appropriate. Table 6 below showcases several programmes that have effectively reached marginalised learners without the use of technology.

Table 6. *Relevant examples of programmes that used no-tech approaches to reach marginalised populations*

Project	Description
Papua New Guinea	In Papua New Guinea, the national school closure plan in response to Covid-19 was based on careful analysis of the technology capacity of a large sample of schools. The assessment indicated that most schools faced significant challenges in delivering remote learning, including limited access to low-tech devices such as basic feature phones, television, and radio. The government recognised these concerns and accepted the importance of a substantial 'no-tech' emphasis on providing printed workbooks supplemented by educational radio broadcasting. While distributing physical curriculum material to communities with limited access to technologies can be costly, the government determined it to be the best approach (↑McAleavy et al., 2020).
Chile	In response to Covid-19, the Government of Chile based its distance learning solution on a systematic review of online capacity of rural communities. It identified 3,700 rural schools with limited or no connectivity. Based on this audit, Chile adopted a 'fit-for-context' approach. Urban schools accessed distance learning course materials through the new online platform, Aprendo en línea, whereas 3,700 remote rural schools were given printed hard copies of the learning course materials (↑McAleavy et al., 2020).
Bangladesh	In January 2019, UNICEF Bangladesh launched a print-based Learning Competency Framework and Approach (LCFA) programme for providing home-based learning to Rohingya refugee children in the Cox's Bazar camps. The programme relies on print-based workbooks for delivering content and learning activities. Instead of acquisition of new skills, the project prioritises consistent engagement of learners (↑UNICEF & World Bank, 2022b).
Argentina: Seguimos Educando ('Continuing to Educate')	The Ministry of Education launched this project as a response to the Covid-19 pandemic. The project used mixed approaches (digital and no-tech) to reach specific student populations. The project provided print-based resources and materials for remote learning for students who lack connectivity or access to technology. Students with connectivity could access the same materials through the Educ.ar online learning platform. (↑UNICEF & World Bank, 2022b).

5. EdTech interventions targeted to children with SEND

EdTech can play an important role in providing children with special educational needs and disabilities (SEND) access to education. The systematic literature review on EdTech for learners with disabilities (↑Lynch et al., 2020) provides a comprehensive overview of EdTech for learners with disabilities in primary school settings. Three main types of technology can be used in school to reach and support children with SEND

1. Majority technology: General tools that do not necessarily feature SEND-specific capabilities like projects, computers, or generic software packages.

2. Accessible technologies: Products, equipment, and systems that provide SEND students with access to content. These include laptop and tablet technologies that include features such as voice or speech recognition, keyboard shortcuts, braille displays, on-screen magnification, subtitles and captions for videos, text prediction, and voice recognition.

3. Assistive technology: Tools explicitly designed to enhance learning for children with SEND. They are often individualised and include devices such as phonetic spelling software, text-to-voice applications, talking calculators, and braille note-takers.

Access to accessible and assistive technology, however, remains limited, as does the evidence of their use in LMICs. Barriers include poor supplies of technology, poor supporting infrastructure, and high procurement costs. Where evidence of use exists, research finds that integrating both accessible and assistive technology, and supporting these with robust pedagogical approaches, can increase communication and motivation and improve learning outcomes for SEND students. A detailed list of accessible and assistive technology with information on costs and availability in LMICS can be found in the EdTech Hub brief on using education technology to support learners with SEND in LMICs (↑Coflan & Kaye, 2020). Select examples of the technology and projects that use EdTech to reach children with SEND are provided in Table 7 below.

Table 7. *Relevant examples of accessible and assistive technologies*

Project	Description
The Orbit Reader 20	The Orbit Reader 20 is a braille display, book reader, and note-taker. It can be used as a standalone device that reads directly from SD cards or can be connected to a computer or mobile phone. The device is language-agnostic (↑Orbit Research, 2016).
Jot-A-Dot	Jot-A-Dot is a pocket-size mechanical brailler weighing just 350 grams. It uses direct six-key Braille entry for fast and accurate brailling. An evaluation by the international development organisation School-to-School International found that primary school students in Lesotho who are blind or have low vision felt more engaged and thought Jot-a-Dot devices improved their reading (↑Harpo, 2020).
The Dot Mini	The Dot Mini is a smart Braille reader that also integrates audio technology. The device can provide access to books, magazines, and even movies. The same company also manufactures the Dot Watch, which is a smartwatch equipped with Braille functionality (↑HundrED, 2020).
Project Ray	Project Ray aims to deliver the benefits of smartphones to visually impaired people. The project combines simple gestures, tactile touching, voice recognition, and audio feedback to replace the traditional image-dependent smartphone platforms (↑Project Ray, 2018).
Big Launcher	Big Launcher is a mobile phone platform that aims to make smartphones accessible to those with visual impairments. Using large, user-friendly, and customisable icons, the interface can be adapted for use by a wide range of users (↑Big Launcher, no date).

Most of the technologies described above require the procurement and distribution of either devices or the technology itself. Select examples of projects that have procured or distributed EdTech to reach children with SEND are provided in Table 8 below.

Table 8. *Relevant examples of projects that have procured or distributed EdTech to reach children with SEND*

Project	Description
The Family Education Services Foundation in Pakistan	The Family Education Services Foundation (FESF) in Pakistan is working with FCDO to deliver laptops and USBs with signed video lessons to 1,200 deaf children. New learning content (in Pakistan Sign Language, visual stories, and recorded signed lessons) and devices are delivered through FESF's pool of mini-buses and local partners. FESF has set up a laptop lending agreement between the school and children's families. Supplementary worksheets are distributed by the school to the children twice a month on USBs (↑Lynch et al., 2020).
The ARM initiative in Bangladesh	The Accessible Reading Materials (ARM) initiative in Bangladesh has produced DAISY (Digital Accessible Information System) digital multimedia books, accessible ebooks, and digital Braille books for learners from Grades 1–10. As part of the project, 33 primary school textbooks and 72 secondary school textbooks were converted into DAISY multimedia format. The digital textbooks are accessible to all, including students with visual disabilities, print disabilities, and learning disabilities (↑UNESCO, 2021).
Deaf Reach Pakistan	Deaf Reach, which is also run by FESF in Pakistan, creates digital content in Pakistan Sign Language and provides it to students on laptops (↑Deaf Reach, no date). The programme found that learning outcomes were enhanced when paired with bi-weekly calls with a teacher. Deaf learners showed a 35% higher rate of improvement compared to learners who were only provided with a laptop and digital content. EdTech Hub partnered with Deaf Reach to conduct a sandbox to test which EdTech interventions worked best to support deaf learners. A summary of findings from that experience is available in two reports by ↑Rahman et al. (2020) and ↑Rahman et al. (2021).
Global survey conducted by the World Bank's Inclusive Education Initiative	This World Bank survey emphasised several solutions to reach children with disabilities, including: ■ First, identifying the ICT needs of each learner with a disability. There are no one-size-fits-all approaches for effective remote teaching modalities and methods, especially for learners with disabilities.

- Broadcast media (television and radio) may be less useful in reaching students with SEND than children in rural and remote communities if educational content delivered through these platforms is not tailored to children with disabilities and their particular needs.
- In remote communities and households with limited access to the internet and technology, printed materials and books are most effective.
- Remote teaching and learning cannot just involve providing homework or assignments or online lessons. It should also include explanations from teachers and feedback loops to monitor learners' progress. Good practices involve regular check-ins to assess learning and the socio-emotional well-being of learners and their families (↑World Bank, 2021).

6. EdTech interventions targeted to girls

As with other marginalised groups, EdTech has the potential to reach girls in LMICs. However, a rapid evidence review conducted by EdTech Hub found that there is a significant gender-based digital divide between boys and girls. Cultural bias and gendered assumptions about girls' competence and the benefits they accrue from utilising technology mean that girls are afforded less access to it both inside and outside the classroom. This is true in spite of the fact that access to technology has been shown to be disproportionately empowering for girls relative to boys. Given gendered assumptions about girls, parents and teachers are often key gatekeepers to girls' access to technology. Exploring a broader range of technology options, particularly mobile phones, may facilitate more inclusive learning opportunities for girls. More information on EdTech interventions targeted to girls can be found in EdTech Hub's rapid evidence review of girls and technology (↑Webb et al., 2020), a Q&A on using technology to support gender equity (↑Allier-Gagneur & Moss Coflan, 2020), and lessons on how to support marginalised girls (↑Naylor & Gorgen, 2020). Many of the examples in Table 9 below are drawn from the UKaid-supported Girls Education Challenge (GEC) programme.

Table 9. *Relevant examples of initiatives to support marginalised girls with better access to EdTech*

Project	Description
iMlango Kenya	iMlango in Kenya has been running an FCDO-funded programme to support 70,130 marginalised girls to improve their learning and transition to the next stage of education, using satellite broadband technology. During the Covid-19 pandemic, they developed a mobile phone app to be used on parents' mobile phones to ensure girls and boys could continue learning from home (↑iMlango, 2022).
EDGE — Nepal	The English and Digital for Girls' Education[3] (EDGE) component of the Sisters for Sisters project supports 1,350 adolescent girls through girls' clubs that already use radio to provide teaching and learning (↑VSO, 2021).
TEAM Girl Malawi	Based on a rapid assessment, the project decided to use a no-teach approach that included group circles and

[3] https://girlseducationchallenge.org/media/ugbl3jm3/dtl_casestudy_sisters_may2021.pdf Retrieved 29 November 2022

	distribution of home learning materials to 5,000 out-of-school girls (↑Link Education International, 2021).
Crane and Viva Uganda	The organisation Crane and Viva[4] support nearly 10,000 girls through mixed modalities that include the distribution of printed learning materials and specialised content through radio and TV (↑CRANE and Viva, 2021).
GEARR (Girls' Enrolment, Attendance, Retention and Results) PEAS (Promoting Equality in African Schools) Uganda	PEAS' GEARR-ing up for Success After School project[5] in Uganda supports 7,493 girls. During the Covid-19 pandemic, the programme used radio and phones to reach girls (↑PEAS, 2021).
Girls Education Challenge Nepal	Girls Education Challenge has five projects in Nepal.[6] During the Covid-19 pandemic, projects considered whether girls and their families had access to technology such as phones, radio, or the internet and whether using these modalities for educational delivery would be effective. Given girls' limited access to technology, projects deployed a range of delivery modes including radio, telephone calls, self-learning packs, and small-group learning (↑Girls' Education Challenge, 2021).
Supporting Adolescent Girls' Education Zimbabwe	The Supporting Adolescent Girls' Education (SAGE) foundation in Zimbabwe is a print-based remote-learning project aimed at reaching out-of-school girls who have either never been to school or have dropped out. The programme is reaching over 5,000 marginalised out-of-school girls aged 10–19. Even though the materials are in English, community educators are able to translate them into local languages (↑UNICEF & World Bank, 2022b).

[4] https://girlseducationchallenge.org/media/d1rlvtyc/dtl_casestudy_schip_may-2021.pdf Retrieved 20 November 2022

[5] https://girlseducationchallenge.org/media/sl5nzci0/dtl_casestudy_gearr_may-2021.pdf Retrieved 29 November 2022

[6] https://girlseducationchallenge.org/media/wy4ludpu/gec_country_briefing-_nepal_october-21_v1.pdf Retrieved 29 November 2022

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