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HELPDESK RESPONSE 27

Effective Use of EdTech for Remedial Learning Programmes

Considerations for Mongolia and other LMICS

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Author Arjun Upadhyay
James Shoobridge
Caitlin Moss Coflan

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Abbreviations and acronyms

ESIS	Education Sector Information System
GPE	Global Partnership for Education
ICT	Information Communication Technology
IRC	International Rescue Committee
ITPD	Institute of Teachers Professional Development
MECSS	Ministry of Education, Culture, and Sciences
NFMSE	Non-Formal Middle School Equivalency Programme
NFC	Non-formal education centre
RET	Relief & Resilience through Education in Transition
UNHCR	United Nations High Commissioner for Refugees

1. Introduction

The Covid-19 crisis has handicapped the ability of national actors to provide education for all. At the peak of the crisis, approximately 1.6 billion learners in more than 190 countries were out of school (↑World Bank, 2020e).

School closures can have a significant negative impact on learners. Young children lose out on learning during their foundational development years. Some may miss their most nutritious meal of the day, and many students — especially girls — may lose out on the opportunity to complete their education (↑World Bank, 2020e). The crisis has the potential to offset hard-won gains in access to education and learning levels, irreversibly damaging the lifelong opportunities of millions of children (↑World Bank, 2020e).

As countries plan to reopen schools, incorporating remedial programmes that aim to mitigate or even reverse learning losses will be crucial. The World Bank estimates that five months of school closures due to Covid-19 will result in a loss of 0.6 years of schooling. It estimates that school closures will cost students nearly USD 10 trillion in earnings over time (↑World Bank, 2020e). In the absence of remedial programmes, Brookings estimates that children could lose more than a full year's worth of learning, even from a three-month school closure, as learning losses will be compounded even after a return to school (↑Kaffenberger, 2020).

Mongolia, like other countries, is considering the introduction of remedial programmes as part of its school reopening plan to combat learning losses. As a result, the World Bank Mongolia team has requested EdTech Hub to:

1. Outline the evidence of effective practices on remedial education generally.
2. Explore appropriate uses of EdTech to support remedial education.
3. Summarise the implications of these findings for Mongolia.

This brief expands on the work of ↑Schwartz (2012) who reviewed the global literature on remedial programmes and identified key design and implementation features and builds on other studies that explored the use of EdTech and remedial programmes in low- and middle-income countries. Evidence on the use of EdTech and remedial programmes, specifically in Mongolia, were also reviewed for this brief.

2. Remedial education programmes

In this section, we consider the following questions:

1. What are remedial programmes?
2. What is the impact of remedial programmes in improving core competencies?
3. What are important steps to consider when designing remedial programmes?
4. How is technology commonly used in remedial programmes?
5. How effective is EdTech as part of remedial programmes?

2.1. What are remedial programmes?

Remedial programmes are defined as specific educational interventions aimed at addressing the learning needs of children who are lagging behind academically or not mastering specific core competencies (↑Schwartz, 2012). Children who have been excluded, who live in remote or conflict-affected areas, orphans, and other vulnerable groups are traditionally the most likely target population for remedial education. Remedial programmes take many forms and may include after-hours catch-up learning, non-formal education, equivalency programmes, and selected remedial subjects.

There is considerable overlap between remedial and accelerated learning programmes. ↑Baxter & Bethke (2009) define accelerated learning programmes as programmes that provide the same content as the national curriculum but at a faster pace and one that often targets over-age children. Remedial education often focuses on the mastery of core competencies such as reading and mathematics (↑Baxter & Bethke, 2009). One key difference between the two is that remedial education seeks to help students catch up on missed learning, whereas accelerated education speeds up learning, whether education was missed or not.

Although there is significant overlap between accelerated learning programmes and remedial programmes, this document emphasises the use of EdTech for remedial programmes. These usages generally can also be applied to accelerated learning programmes.

2.2 What is the impact of remedial programmes in improving core competencies?

The evidence suggests that well-designed remedial interventions can yield fast and significant improvements in core competencies (↑McLaughlin & Pitcock, 2009; ↑Schwartz, 2012; ↑Longden, 2013; ↑Banerjee, et al., 2016). Below we discuss this evidence.

Results from a randomised experiment of a remedial science education programme in Peru found that students in the remedial programme scored 0.12 standard deviations higher on the endline test than peers in the control group (↑Saavedra, et al., 2017). In Liberia, remedial interventions for students in Grades 2 and 3 resulted in significant improvements in Early Grade Reading Assessment scores after only four months (↑Poole & Crouch, 2008), cited in (↑Schwartz, 2012).[1] In Nigeria, an accelerated learning programme for out-of-school children focused on and reported significant improvements in literacy and numeracy (↑IRC, 2019a).

Accelerated learning programmes targeted to the most disadvantaged children have also been shown to be effective in many low- and lower-middle-income country contexts. They have been effective both for bridging periods of learning loss and as pathways for successful re-entry of out-of-school children (↑Longden, 2013; ↑Banerjee, et al., 2016).

Summer and after-school learning programmes that used trained teachers or volunteers, structured pedagogy, enrichment experiences (music, arts, and sports), and high levels of teacher–student engagement, can generate significant learning gains for disadvantaged populations (↑McLaughlin & Pitcock, 2009). A study of the International Rescue Committee's (↑IRC, 2019b) remedial tutoring programme that targeted internally-displaced and refugee children in Niger found that the addition of enrichment sessions such as 'Mindfulness' and 'Brain Games' had a positive impact on children's school grade average.

Other interventions found in remedial education and accelerated learning programmes, such as after-school tutoring and peer-to-peer coaching, also hold promise (↑Education Endowment Foundation, 2018).

EdTech has been used to enable students in challenging environments such as refugee camps, to gain access to education. In Mauritania, following the

[1] Children in the programme increased letter naming fluency by 21.0 letters per minute, phonemic awareness scores by 17.7%, familiar word fluency by 15.7 words per minute, unfamiliar word fluency by 12.8 words per minute, oral reading fluency by 24.3 words per minute on connected text, and reading comprehension by 30.2%.

prolonged closure of schools due to Covid-19, the United Nations High Commissioner for Refugees (UNHCR) has been actively supporting distance learning in Mbera camp (↑UNHCR, 2020). UNHCR conducted training for trainers on distance education at primary and secondary levels in Mbera camp. Some students have been able to resume their studies, using the techniques shared in the training such as the use of the WhatsApp platform and through local radio. Small study groups were organised and teachers would take calls from learners. The learners would put the phone on speaker to make it easier to listen to the teacher explain a concept or answer a specific question.

In Kenya, in 2016–2018, the humanitarian organisation RET International implemented a project in Dadaab refugee camp where technology-supported learning was offered in an accelerated learning programme through the use of television, online content and pre-recorded video lessons (↑Boisvert, 2017). The video lessons, recorded by qualified and experienced teachers from high-performing schools in Kenya, enabled learners to access quality teaching. The strategy was used to complement classroom teaching, thereby enhancing acquisition of knowledge. The refugee teachers and peer teachers / teaching assistants benefited from seeing how qualified teachers delivered lessons and this was an aspect of capacity building and transfer of skills.

2.3. What are essential steps to consider when designing remedial programmes?

In the following subsections, we discuss the importance of conducting assessments to identify the target population, options for determining how and who will deliver remedial education, and the importance of training educators and aligning content to the curriculum.

2.3.1. Conduct assessments to identify the target group and understand their learning needs

Studies have shown that tailoring instruction to the level of the student improves learning outcomes (↑Banerji & Chavan, 2016; ↑Teaching at the Right Level, 2020). Providing personalised learning begins with an understanding of the current learning levels of students and their specific learning needs. As a result, a crucial first step in designing a remedial programme is to conduct assessments on student needs (including education, cost barriers, nutrition, etc.) (↑Schwartz, 2012; ↑Baxter & Bethke, 2009).

Results from learning assessments can be used to identify the target population for remediation and additional support. In the Educational Support for Children of Underserved Populations (ESCUP) programme in

Cambodia, students in 167 primary schools and 19 lower secondary schools, who scored below average on the first term semester exams for Khmer language and mathematics, were selected to receive remedial instruction (↑Schwartz, 2012). In Malawi, as part of the Government's plan to reopen schools in Autumn 2020, all schools are expected to evaluate learning levels using end-of-term assessments. The assessment will "inform the teachers on the learning gaps and assist in planning for remedial lessons including teaching at the right level of the child" (↑GPE, 2020, p. 17).

It is important to note that in any nationwide assessment, clear communication with students, teachers, and parents about how the results of the assessment will be used is important. ↑Chuang & Mullan (2020) recommend that "governments should set expectations that the exams will be solely used for diagnostic purposes, and not for high-stakes testing to determine progression to the next grade."

2.3.2. Determine how the programme will be delivered

There is some evidence that successful remedial programmes have used a variety of modalities for delivery and instruction (↑Banerjee, et al., 2010; ↑Duflo, et al., 2011; ↑Banerjee, et al., 2016). Common modes of delivery that have been implemented in the past include the following.

Small-group tutoring

Small-group tutoring models are ideal for close tutor–pupil interaction and for its personalised effects. However, given the level of human resources required, they are usually costly to implement (↑Schwartz, 2012). Nevertheless, there are some examples of low-cost remedial programmes that have effectively used small-group tutors, such as the Balsakhi programme (↑Banerjee, et al., 2007).[2]

Separate classrooms

Space permitting, schools can form separate classrooms to support low-achieving students. In ↑Instituto Ayrton Senna (2020), the national remedial programme of Brazil, some public schools formed separate classrooms for low-achieving students. Students in the remedial programme returned to the regular classes once they mastered the required skills (↑Schwartz, 2012).

[2] The Balsakhi programme in India is a low-cost example of an effective small-group tutoring programme. Children from Grades 3 and 4 are taken out of the classroom to work with women tutors in groups of 15–20 for two hours each day (the school day lasts about 4 hours). The tutors were paid low fees by Prathma, the implementing NGO (India: Banerjee, Cole, Duflo, & Linden, 2006).

Remedial education during school hours (curricular) or after school hours (co-curricular and extra-curricular)

Small-group tutoring and separate classrooms can be implemented during or after school hours. According to ↑Georgescu, et al. (2008), cited in ↑Schwartz (2012), the basic education curriculum in Mali allocates 25% of weekly time for remedial activities during school hours. Similarly, the primary curriculum in Botswana allocates between 315–405 minutes per week to remedial activities during school hours. Summer programmes have also yielded improvements. A two-month summer remedial programme in Senegal called PARI (Partenariat pour l'Amélioration des Rendements Internes à l'Ecole Elémentaire or Partnership for Elementary School Internal Performance Improvement) showed improvements in the reading and maths levels of students (↑Schwartz, 2012).

Regardless of the chosen modality, there appears to be some indication that remediation is most effective as a supplement to existing instruction rather than the primary means of instruction (↑He, et al., 2009). The study from ↑He, et al. (2009) also suggests that remedial programmes are more effective when implemented as a complement to school curricula rather than as a stand-alone.

Implementing any of the above modalities during Covid-19 should be guided by the best interests of the children and overall public health considerations. The brief issued by ↑UNESCO, et al. (2020, p. 2), suggests that decisions to reopen schools (including remedial programmes) should be

> *"based on an assessment of the associated benefits and risks and informed by cross-sectoral and context-specific evidence, including education, public health and socio-economic factors. This analysis will also help to prioritize risk mitigation measures. Decision-making should be done together with subnational stakeholders so that actions are based on an analysis of each local context."*

2.3.3. Determine who will deliver the instruction

Remedial education can be delivered successfully by various different types of educators including teachers, members of the community, and even by student peers (↑Banerjee, et al., 2010; ↑Duflo, et al.,2011; ↑Banerjee, et al., 2016). Ideally, such educators need to have support and access to professional development so that they are well equipped to meet the learning needs of all students.

Teachers

There is strong evidence that teachers who receive high-quality, effective professional development are more effective in working with low achievers than teachers without quality teacher education (↑Schwartz, 2012; ↑Westbrook, et al., 2013; ↑Pryor, et al., 2012; see also ↑Allier-Gagneur, et al., 2020b). Training teachers to be able to identify low-performing students and provide the tools to address low achievement can yield important learning gains, particularly in low-income countries.

Community members and volunteers

A review of alternative approaches to educational delivery in low- and middle-income countries showed that motivated young adults, often with few formal qualifications, can serve effectively as teachers when provided with ongoing professional training and support (↑Contreras & Herrera, 2007; ↑Banerjee, et al., 2007). Based on a systematic review of literature in the United States, ↑Ritter, et al. (2006) found that volunteer tutoring programmes are an affordable way for low-income children to access remedial programmes.

2.3.4. Educate teachers and instructors

As with teachers, training for volunteers and community members is essential for remedial programmes to be effective. Regardless of what medium is used or who is delivering the programme, it is imperative that educators are supported. Planning for remedial programmes should begin with conducting assessments to measure the capacity of available teachers to support remedial education (↑Chuang & Mullan, 2020). There are a number of important practices in effective remedial programmes (↑Allier-Gagneur, et al., 2020a), including:

- providing professional development to educators on teaching the national curriculum;
- making sure that educators understand the remedial programme;
- providing ongoing support for educators to apply evidence-based strategies to help low performers.

2.3.5. Align content with the school curriculum

As with other alternative education interventions, remedial programmes need to be aligned or integrated with the national curriculum. ↑Schwartz (2012) found that remedial education programmes are likely to be effective when included as part of a country's overall strategic plan and curriculum to deliver quality education for all of its students.

Similarly, a 2013 assessment of 12 accelerated learning programmes found that focus on foundational numeracy and literacy were common components of successful accelerated learning programme curricula (↑Longden, 2013). In comparing the success of accelerated learning programmes with progression against the regular curriculum, there are several complicating factors to consider. For one, children in accelerated learning programmes may be able to learn faster because they are older than those in schools. In addition, assessments at the primary level are often not based on the full range of subjects taught, which may complicate comparisons of accelerated learning programmes to traditional education progression.

The decision whether to focus on core components of the curriculum or to accelerate learning of the entire curriculum will ultimately depend on the learning needs of children and the extent to which financial and human resources are available.

2.4. How is technology commonly used in remedial programmes?

Major and Francis' recent review of personalised learning programmes that have used EdTech indicated that a range of digital technologies is being used. However, the majority of EdTech used in remedial programmes is typically for computer-assisted learning via tablets or PCs. A handful of programmes have used mobile technologies to support remediation (↑Major & Francis, 2020).

Computer-assisted learning uses specialised software for the development of cognitive skills, such as mathematics or reading comprehension and uses computers for instruction, drills, exercises, and simulations, to improve educational outcomes (↑Gambari, et al., 2016; ↑Lai, et al., 2015; ↑Lai, et al., 2013; ↑Bai, et al., 2018; ↑Mo, et al., 2014). Computer-assisted learning can be used in conjunction with automated formative assessment, promoting learning at the right level. Also, computer-assisted learning offers the opportunity to accurately monitor the actual time that students are exposed to the intervention. More recently, such assessments take advantage of emerging machine-learning techniques capable of modelling students' cognitive processes, further enhancing content mastery (↑Angel-Urdinola, 2020). Computer-assisted learning mostly targets instruction in single subjects: mathematics, science, and English; however, some programmes target multiple subjects and social skills.

In addition to the use of computers, programmes can be accessed on tablets and telephones with internet access (↑Angel-Urdinola, 2020). Mobile devices are being employed more and more for facilitating remedial learning, owing to their increasing availability in low- and middle-income environments and their low cost when compared to other types of devices. For example, the India BridgeIT programme began in 2011 with the initial objective of improving fifth- and sixth-grade English and science student learning outcomes (↑Carlson (2013). Hardware for the programme included smartphones with a TV-out port, a prepaid SIM card, TV-out cable, and a TV monitor or LCD projector. An open-source, free learning platform was used. Content was sourced from a curriculum-based catalogue of approximately 400 educational videos, with 90–100 videos for each grade and subject. The video lessons were shown to students via the TV monitor or projector. Teachers received training and support on how to use the software, including ordering and downloading videos.

When considering the use of technology for remedial programmes, it is absolutely imperative to consider what technology is already available to learners. In some low-income contexts, the funding available per child is as little as USD 2 per child per year; even the cost of the cheapest technology-based child-level interventions may still be around USD 20 per child per year, making them unaffordable. It is more realistic to use technology where technology is already available to families and where the children have access to the technology. To conduct preliminary assessments, the spider diagrams in ↑Haßler, et al., (2020i) can be used. In Section 4, we discuss further the use of radio and TV in remedial education.

2.5. How effective is EdTech as part of remedial programmes?

Technology-supported remedial learning programmes and accelerated learning programmes appear to offer significant promise to improve learning outcomes. A rigorous review of literature by ↑Tauson & Stannard (2018, p. 54) concluded that,

> *"there is evidence to suggest that EdTech can be used alongside accelerated learning programmes, providing opportunities for children to catch up and get back into public schools, or for out of school over-age children to complete a primary education in half the time."*

This insight is based on evidence from India (↑Banerjee, et al., 2007; ↑Linden, 2008; ↑Muralidharan, et al., 2019;↑Nedungadi, et al., 2014). Further, the report states that "some evidence suggests that poorly performing children can benefit more from EdTech than their high achieving counterparts" (↑Linden, 2008;↑Muralidharan, et al., 2019).

↑Nedungadi, et al. (2014) implemented a small study in Kerala, India, with 38 students from marginalised groups, in order to assess the effectiveness of using low-cost tablets to improve learning outcomes in maths, reading (both the local language and English), and writing. Findings were qualitative, so the effect is not measured precisely, however, findings seemed to indicate that children learned faster, specifically in reading. The apps on the tablets used pedagogy that was aligned with the curriculum and songs and stories from the area, all in the local language. Teachers and students reported increased motivation, engagement, and accelerated learning.

↑Muralidharan, et al. (2019) evaluated a technology-aided learning, after-school programme in urban India. Children who were the furthest behind saw the greatest improvement. In this randomised controlled trial, those who took part in the intervention "experienced twice the test score value-added in math and 2.5 times that in Hindi" compared to the control group. The authors identified that the personalised learning software played a greater role in determining improved learning outcomes than the grade level in which the child is enrolled.

A study conducted by ↑Banerjee, et al. (2007) evaluated two remedial programmes in India. In the first programme, children were provided with a tutor. The second programme was a computer-assisted learning programme where students had two hours of shared computer time per week (↑Banerjee, et al. (2007).[3] While both programmes were extremely effective, the computer-assisted learning programme produced slightly larger effect sizes. The computer-assisted learning programme was found to be even more effective in the second year as opposed to the first after programme developers aligned content more closely to the curriculum.

The India BridgeIT programme had a strong, positive, and statistically significant effect on student learning for both science and English (↑Carlson, 2013). BridgeIT was observed to improve the quality of teaching. English language instructional programmes compensated for teachers' poor English pronunciation skills and corrected students' prior learning of incorrect pronunciation (↑Carlson, 2013).

The use of EdTech in remediation programmes may also provide an opportunity to learn how to use ICT. In a recent evaluation of a Non-Formal Middle School pilot programme in Myanmar, parents and students believed

[3] Two children shared one computer for one hour during class time and one hour either immediately before or after school.

that the inclusion of ICT-enabled learning enhanced student opportunities to transition into jobs, vocational education, and higher education (↑UNICEF (2019)).

As noted above, when considering the use of technology for remedial programmes, it is imperative to consider the appropriate use of technology, including costs. It is clear that, in principle, in well-resourced settings, technology has a role to play in education (↑Education Endowment Foundation, 2018). However, in practice, particularly in poorly resourced settings, technology may well not be a feasible option that reaches the children who need to be reached. For some considerations on the different uses of technology in education, see ↑Haßler & Moss (2020). For an overview of evidence on technology-focused 'Covid-19 learning continuity' interventions that are not reaching the poorest children, see ↑McBurnie & Haßler (2020).

3. Mongolia context

In this section, we analyse the education sector in Mongolia, describe existing EdTech policies, initiatives, and infrastructure, and highlight the importance of targeting education to Mongolia's Nomadic population. Necessarily, this repeats some of the information already available in World Bank programme appraisal documents.

3.1 Education sector analysis and governance

The Mongolian education system consists of five years of primary school, four years of lower secondary school, and three years of upper secondary school (↑World Bank, 2013). Upper secondary school is free but not compulsory. These education services are overseen by the Ministry of Education, Culture, and Sciences (MECSS), the central administrative body that formulates national educational policy and sets the standards for each level of formal education (↑ADB, 2008). The ministry administers teacher training, curriculum development, and state examination procedures, and is responsible for the accreditation of higher education institutions (↑ADB, 2008).

Gross enrolment rates are high in Mongolia, at 99.1% for the primary level, 101.7% for lower secondary and 98.4% for upper secondary (↑MECSS, 2019). Most teachers have received pedagogical training with 98.8% of teachers in primary and 99.25% of teachers in secondary school meeting national qualification standards. Classroom sizes are manageable with 30.2 pupils for each teacher.

Schools are distributed over large areas of low population and in many areas services are not available. Mongolia has one of the lowest population densities and population growth rate is 1.11% (2018 est.). The capital city, Ulaanbaatar, accounts for half of the total population (↑CIA Factsheet, 2020).

3.2. EdTech policy and initiatives

In recent years, the government has led concerted efforts to integrate ICT into the public sector. Current government reforms have focused on developing an ICT master plan, improving the EdTech infrastructure, and updating the hardware and software in schools. Additional areas of focus include prioritising human resource development and content development.

Mongolia has a long history of using EdTech. The government has used EdTech such as the online learning platform Moodle, ↑Mathshop[4] and ↑Suraad[5] to improve teaching instruction, deliver curriculum contents, and support teacher education (National Statistical Office).[6] The Institute of Teachers Professional Development (ITPD), the entity responsible for teacher education in Mongolia, uses web browser training as a component of its basic professional development for teachers. The institute also uses Moodle to deliver EdTech to schools that are able to access it.

The Mongolian Institute for Educational Research (MIER), in cooperation with ITPD and Ulaanbaatar Metropolitan Education Department and Mongolian Online Studying System (MOSS), has piloted ↑Mathshop,[7] a mathematics e-learning software aligned with the Mongolian curriculum for students in Grades 1–12. The programme specifically targets children from low-income households. The current number of users is 160 and the annual fee is USD 30.9 (88,000 MNT).

↑Suraad is a browser-based mathematics exercise book for high-school students, parents, and teachers. It is necessary to have access to the internet and a PC to use Suraad as its interface does not have multi-device support. There is a monthly fee of approximately USD 10 (30,000 MNT) to use the programme.

These applications require web interfaces and good internet connectivity, which limit their use, but they do demonstrate the openness to using EdTech to facilitate classroom learning in Mongolia.

3.3. EdTech infrastructure

Mongolia's ICT infrastructure has changed extensively in the last ten years. ICT has penetrated into almost all sectors of the economy and society of Mongolia. Fibre-optic cables are connecting hospitals, police stations, and schools in 90%

[4] http://www.mathshop.mn

[5] http://www.suraad.mn/login

[6] National Statistical Office (NSO), Methodology for estimating ICT statistics in education, Ulaanbaatar: NSO, 2010, 1/175.

[7] The features of this software are that 1) it is possible to select online learning or offline learning according to the learning environment of the user, 2) it is compatible with Mongolian and English, and 3) it utilises illustration, voice, and the ranking function to increase children's interest.

of *sums*[8] (↑UNICEF, 2020). Mobile phones are widely used among citizens and internet connectivity through 3G is close to universal (↑JICA, 2019).[9] In 2018, almost every household including poor and rural residents in Mongolia had at least one mobile phone at home (↑World Bank, 2020b). 4G coverage is limited to 27% of the population (↑GSMA, 2020).

Household wealth also plays a factor in access to technology and public access to computers remains limited in poorer socio-economic groups. A 2015 survey by the World Bank, found that while most families had electricity, only 1.4% of the poorest households had a computer compared to 98.2% of the wealthiest households (↑World Bank, 2017b).[10] However, the same survey determined that approximately 20% of families had a radio but almost all families had a television. In the poorest quintile of families, 93.4% owned a television.

A ↑World Bank (2020b) household socio-economic survey conducted in 2018 determined that only one out of four households in the bottom quintile had access to the internet. In contrast, nearly two-thirds of the richest households are connected to the internet. The digital divide might prevent poor and rural children from gaining exposure to ICTs and opportunities for learning, connecting, and sharing information. Similar experiences during the Covid-19 pandemic are described in the publications summarised by ↑McBurnie & Haßler (2020).

[8] Secondary subdivisions outside Ulaanbaatar are called *sum* (сум, often transliterated as *soum*). In 2006, Mongolia had 331 *sums*.

[9] 95% of the population is connected to 3G mobile networks resulting in a number of internet subscribers reaching 2.6 million people, which is an increase of 10% in comparison with the previous year. 2.4 million people or 91.5% are subscribers of mobile communications and 226,100 people are subscribers of fixed communications. At the global level, the total internet bandwidth is 185,000 Gbit/sec. In Mongolia, the total internet bandwidth reached 100 Gbit/sec, which indicates an increase of 62.6% in comparison with 2015. One point five per cent (1.5%) of fixed Internet subscribers in Mongolia are connected with speeds over 10 Mb/sec, and 98.4% – 256 Kb/sec-10 Mb/sec. The telecommunications backbone network of Mongolia covers 299 *sums* in 21 *aimags* (provinces) and is composed of 36,760 km of the fibre optic network, totalling more than 3,000 km and 86 stations of analogy radio relay network and 249 stations of digital technology radio relay lines and very-small-aperture-terminal (VSAT) satellite network.

[10] The survey was only conducted in households with students enrolled in public fixed kindergartens.

Table 1. *A summary of ICT Education indicators in Education. Source: ↑MECSS (2019), ↑ITU (2018)).*

ICT Key indicators	Statistics (2017)
Mobile-cellular sub. per 100 inhab.	126.4
Active mobile-broadband sub. per 100 inhab.	80.8
3G coverage (% of population)	95.0
Individuals using the Internet (%)	23.7
Households with a computer (%)	32.6
Households with internet access (%)	23.0
Fixed-broadband sub. per 100 inhab.	9.3

Official statistics show that 96.6% of schools have access to electricity, 68.4% have access to the internet, and 95.4% have access to computers (↑MECSS, 2019). Efforts have also been made to improve infrastructure and connectivity to rural areas. The Mongolia Information and Communications Infrastructure Development Project, started in 2013 by the World Bank, resulted in improved access to the internet in rural areas (↑World Bank, 2015).

Although these statistics suggest a strong environment for EdTech to flourish, significant challenges remain. A recent ↑JICA (2019) study, based on school inspections, found discrepancies with the official data. In the largest school in Mongolia,[11] inspectors found that 19% of teachers (30 out of 158 teachers) did not have computers despite government efforts to provide a computer for every teacher.[12] Teachers reported that it had been five years since MECSS supplied computers and that many existing computers were broken. ICT equipment such as projectors, displays, and computers was "not well installed", and therefore was not used by teachers. In another school, the authors found that only 10 out of 30 computers in a lab were functional and that classrooms were not connected to the internet.[13]

[11] No. 62 School consists of 4,356 students enrolled in Grades 1–12 (2019) andis located at Songinokhairkhan district of Ulaanbaatar.

[12] The report found that schools supported by international aid projects are better equipped than public schools.

[13] No. 57 School is located at Chingeltei district of Ulaanbaatar and has 2,320 students and 66 teachers (2019).

Figure 1. *Donor-supported EdTech-focused programmes in Mongolia (Source: ↑JICA (2019)).*

UNESCO is working with the Mongolian National Commission on a project called Enhancing National Capacity to Foster Digital Citizenship Education in Asia-Pacific from 2017 until 2021.[14] The project aims to establish standards and curriculums for ICT skills required for teachers of primary and secondary schools. The project is now at the stage of the submission of a draft of the standard to MECSS.
The Korean International Cooperation Agency (KOICA) planned to commence a capacity-building project for the School of Information and Communication Technology at the Mongolian University of Science and Technology in 2019. The project includes the drawing up of an ICT in education master plan for schools, curriculum development according to international standards, establishing information technology (IT) laboratories, procurement of equipment, and building renovation. The tender was closed in August 2019 and the present status of the project is not listed. It is not clear which schools will benefit from the project.

3.4 Learning in nomadic communities

Approximately 30% of Mongolia's population is nomadic. In 2019, 20% (114,198) of students enrolled in primary and secondary schools were nomadic children. [15] Nearly 35,196 nomadic students attend and live in seasonal boarding schools (dormitories).

The ↑World Bank (2018) notes that lower school attendance, living arrangements, and academic performance of pastoralists' (nomadic) children are challenges in the sector. First- and second-graders from herder families performed significantly poorer at early grade Mongolian-language reading and numeracy assessments conducted in 2017 than children from non-herder families.

Rural nomadic children are unlikely to have access to laptops and tablets at home although urban nomadic children are likely to have access to electricity, internet, and mobile devices (↑World Bank, 2018). Nomadic herders commonly use low-voltage, portable solar panels, and automobile batteries to generate

[14] Mongolia is one of six target countries including Myanmar, Nepal, Philippines, Sri Lanka, and Uzbekistan.

[15] Children of herders.

electricity for household use. Their use has been supported under government programmes since the early 2000s (↑World Bank, 2018).[16]

[16] For example, the 100,000 Solar Gers programme initiated by the Government of Mongolia in 2001 has enabled 104,000 rural households to use Solar Home Systems. It was sold to herders at a discounted price on government subsidy.

4. Key considerations for enhancing the use of EdTech for remedial education in Mongolia

In this section, we offer several considerations for the use of EdTech in designing a remedial education programme. The use of EdTech in such programmes should not be considered as given; the most successful, scalable, and equitable programmes may well not use EdTech at all.

Considerations are organised under the following subsections:

1. Exploring the delivery model
2. Introducing 'Teaching at the Right Level' approaches
3. Determining the appropriate EdTech platform
4. Supporting teachers and educators
5. Tracking student progress
6. Integrating with the national curriculum
7. Providing teaching and learning materials

4.1. Exploring the delivery model

In this subsection, we provide several remedial education delivery models for Mongolia to consider, some of which include the use of EdTech.

4.1.1. Extra-curricular after-school and compensatory programmes

Mongolia has implemented popular and effective compensatory (remedial) and after-school programmes that could be adopted in the design for wide-scale remedial education. Between 2012 and 2017, the Improving Primary Education Outcomes for the Most Vulnerable Children in Rural Mongolia Project[17] introduced extra-curricular after-school programmes at schools for nomadic children, and home-based compensatory programmes for

[17] With financial support from the World Bank and the Japan Social Development Fund, the project was named as the 'most successful' by the World Bank and Japan Social Development Fund in 2016.

lower-primary out-of-school children (↑World Bank, 2020a).[18] The compensatory programme provided children with an avenue to return to formal school at an age-appropriate grade level, without the need to repeat schooling from Grade 1 or wait until they turned 10 (the official age for entry into the non-formal education programme). The programme developed home-based teaching and learning resource materials for parents / caretakers and children for each grade standard (Grades 1–3) that included both printed materials and self-instructive audio-visual materials. The after-school and compensatory programmes were supported by small-scale, results-based community block grants.

According to the ↑World Bank (2017a), the home-based compensatory and extra-curricular after-school programmes were widely popular and have spread beyond the project even after its close. One hundred and thirty-eight small-scale grants have been awarded to local communities to implement their own initiatives. The small-grants scheme has active involvement of parents and community members as well as local governments (↑World Bank, 2017a).

Challenges

The mid-term evaluation of the home-based compensatory programme revealed several challenges related to the increased demands for parent / caregiver involvement. The evaluation reported that:

1. The seasonal workload of nomadic herders gave herder parents no time to work with their children, due to livestock breeding in the spring.
2. The low level of parental education inhibited them from properly teaching the programme content to their children.
3. A limited number of digital training materials and CDs were provided under the project due to delays.

Importantly, there is no research on the impact of the home-based, compensatory and after-school programmes on student's learning outcomes. However, given that the programme was completed only three years ago, it may be possible to undertake at least some initial research quite quickly. Additional research would also be needed to determine whether the home-based learning approach could work at higher grade levels. Generally

[18] The programme was implemented in 30 *sums* in four provinces with the aim of improving the education outcomes of over 8,000 of the most vulnerable children aged 5–10 in the educationally under-performing and under-served rural areas of Mongolia.

speaking, it may be better to incrementally improve a previous programme (drawing on the successful aspects) rather than move to another programme.

4.1.2. Mobile learning centres

Mobile schools can potentially be expanded to facilitate remedial opportunities for young children of nomadic families. Under the Global Partnership for Education Early Childhood Education Project, Mongolia piloted the use of mobile *ger* (yurt) kindergartens[19] to facilitate access to early childhood education for children of nomadic families (↑Borgen Project, 2016).[20] An evaluation noted that the mobile kindergartens were cheaper to operate than their stationary counterparts throughout the country (↑World Bank, 2017b). *Ger* kindergartens were designed to suit the socio-economic and cultural setting of the nomadic population in Mongolia. *Ger* kindergartens are received enthusiastically by nomadic parents as they allow them to spend more time with their herds, thus elevating their productivity. The mobile schools have been credited with giving thousands of nomadic children access to early education.[21] Mobile schools have been enhanced through the development and printing of visual aids and children's workbooks in accordance with the alternative preschool curriculum.

Challenges

A sub-sector analysis of pre-primary education in Mongolia by the ↑World Bank (2017b) found that cognitive and non-cognitive skills among children enrolled in ger kindergartens after three to four weeks still lagged significantly behind those of children in fixed kindergartens. The report warns that the short duration of the programme has little effect in ensuring children who require remedial education catch up with others (↑World Bank, 2017b).

There are also no examples of mobile schools using EdTech. The benefits of incorporating EdTech into mobile schools will need to be carefully considered when compared to more established and cost-effective solutions such as delivery of EdTech through mobile phones.

[19] https://borgenproject.org/mobile-schools-in-mongolia/

[20] The aim of the Global Partnership for Education — Early Childhood Education (GPE-ECE) Project (2012–2014) was to provide access to early childhood education for children in disadvantaged communities and reduce the social inequality in Mongolia. 100 mobile *ger* kindergartens were established with the GPE grant and benefitted 1,500 children in rural areas (World Bank 2014).

[21] For example, since 2012 more than 2,600 children have attended *ger* kindergartens in Khuvsgul province.

4.1.3. Build on non-formal education and equivalency programmes

In cases where schools have insufficient space or resources to operate additional remedial classes, non-formal education programmes may offer an avenue to deliver remedial education to children attending regular schools.

In Mongolia, non-formal education is provided to children who drop out of school, vulnerable groups, and young adults who have had little to no access to education. The majority of participants of non-formal education programmes are non-literate people and school drop-outs under the age of 15, who want to complete their basic education through 'equivalency programmes' delivered in the non-formal education centres (NFCs). The non-formal education system also reaches children with disabilities who cannot access education, by providing recuperating and remedial education, and offers literacy, equivalency, and life skills programmes.[22] In the 2016–17 academic year, a total of 9,291 people (70% male) of different ages were involved in the equivalency programme. The programme was offered at 355 local NFCs and in 21 provinces, including the capital (↑Venäläinen, et al., 2019).

Challenges

Integrating EdTech into Non-Formal Education Equivalency programmes for remedial learning, will, however, need to be carefully considered. Integrating EdTech into non-formal education programmes to improve learning outcomes in foundational skills may not be effective, as the required infrastructure does not appear to be readily available. Also, as digital literacy among students and teachers is low (↑UNICEF, 2019), there will be significant barriers to effective EdTech use.

4.2. Introducing 'Teaching at the Right Level' approaches

It is accepted that teaching has to be tailored to a child's level, not just in the sense of overall grade level, and that it needs to be tailored to the specific learning challenges children face day-to-day. Approaches like 'Assessment for Learning' have been popular in higher-income countries for some time.

[22] A total number of 1,716 students (18.5%) who were enrolled in the equivalency programme training were [locally] identified as having a disability; 30.9% of them were identified as having an intellectual disability followed by 17.5% having speech and language impairments, 16.7% having visual impairments, 15.7% having physical impairments, 14.7% having hearing impairments and 4.5% having multiple disabilities. The majority of children attending non-formal education programmes come from poor families.

However, more recently, similar approaches in lower-income countries have been recognised as being effective in those settings. In a series of randomised control trials on Pratham's Teaching at the Right Level programme, the Abdul Latif Jameel Poverty Action Lab (J-PAL) found that tailoring content to a child's academic level consistently improves learning outcomes (↑Banerjee, et al., 2016). Overall, approaches like Teaching at the Right Level, Assessment for Learning, Mastery Learning, as well as promoting children's self-regulation and meta-cognition (↑Education Endowment Foundation, 2018) are regarded as highly effective.

It stands to reason that such approaches can be usefully enhanced by the use of technology (cf. computer-assisted learning mentioned above). A rapid evidence review of the use of EdTech in personalised learning programmes conducted by ↑Major & Francis (2020) found that technology-supported personalised learning (mostly in the form of computer-assisted learning) could be particularly relevant to remedial programmes that focus on core subjects like mathematics and reading.

Challenges

However, ↑Major & Francis (2020) conclude that further research is necessary regarding the cost-effectiveness of using EdTech in remedial programmes. While implementing technology-supported personalised learning has benefits, favourable cost-effectiveness can only be achieved if the necessary infrastructure is already in place and functions well. We note that significant resource constraints and challenges (e.g., intermittent network connectivity, lack of battery power, etc.) are often reported in the deployment of technology-supported personalised learning programmes. These challenges must be carefully factored into decisions when considering the use of EdTech in remedial programmes in resource-constrained countries (↑Mutahi, et al., 2017).

4.3. Determining the appropriate EdTech platform

Determining the appropriate technology for remedial programmes requires an evidence-based strategy that identifies how learners within a country can be best served (↑Kaye, et al., 2020; ↑Haßler, et al., 2020i). ↑Allier-Gagneur & Moss Coflan (2020) explain that when any decision on technology is made, policymakers and education decision-makers should sequentially explore the following questions.

1. What are the needs of the learner?
2. What are potential interventions to meet those needs?

3. What role might technology play?

Countries should also take stock of, and where possible, leverage, existing ICT infrastructure for remediation and other education programming as it is expensive and inefficient to introduce significant new ICT infrastructure. Two steps are critical in determining the appropriate use of technology in large-scale remedial programmes:

1. Collect existing and relevant data to understand access to ICT infrastructure and device ownership and use.
2. Analyse data, identify opportunities and challenges in using existing ICT infrastructure and devices for remediation, and carefully weigh whether new investments in ICT infrastructure and hardware are merited.

For further insight into such processes in the context of virtual learning environments, see ↑Adam, et al. (2020).

4.3.1. Multi-modal approaches

It cannot be assumed that the same approach will work for all children. Utilising a range of learning modalities — digital and non-digital — is important in order to reach children from different socio-economic groups. In particular, many digital interventions for learning continuity during Covid-19 do not appear to have the intended impact on learning (↑McBurnie & Haßler, 2020). EdTech Hub (↑Haßler, et al., 2020i) recommends focussing on print, radio, TV, and basic mobile phones for low-income populations; other platforms such as smartphones or laptops will only be applicable to high-income populations. Students who have been left behind may have reduced access to the latest technologies, and so ensuring the use of traditional technologies such as printed material, radio, and television remain more effective and accessible for rural and disadvantaged groups (↑Gulati, 2008). Therefore, in order for remedial programmes to reach nomadic children out of fixed schools, they would likely need to be delivered on easily transportable, low-cost devices. Existing technologies such as Mathsop will need to be more affordable for widespread use. The average wage earner in the bottom consumption quintile earned USD 1,319 (3,755,000 MNT) per annum (↑World Bank, 2020b, p. 42). The USD 30.9 (88,000 MNT) annual fee may be unaffordable for most poor families, not accounting for the costs of computers and internet connectivity.

4.3.2. Considerations for computer use

According to a ↑JICA (2019) survey on ICT infrastructure, there are about 40 ‘Laboratory Schools’ that provide advanced education in Mongolia. The Laboratory Schools use web-based EdTech solutions such as Moodle to manage educational data in the school and to deliver the teaching materials and complement curriculum delivery. Some classrooms are equipped with tablet devices. In this environment, it was reported that Moodle reduced teachers' workload and increased the quality of lesson preparation and that by using EdTech such as Moodle, students can catch up by self-learning even if they are absent from classes. Students in a Laboratory School that was inspected prefered digital teaching materials over paper-based materials as they were familiar with digital devices (↑JICA, 2019, pp. 43–44).

Challenges

Official statistics concerning computer provision in schools may not properly reflect the actual state of computer equipment and access in schools (↑JICA, 2019). Given that reports stating that computers in schools are sometimes 'broken' or not installed, interventions heavily dependent on students accessing computers would likely severely limit access. Although most Laboratory Schools have an environment where they can connect to the internet, connectivity is often slow, particularly in schools located in rural areas. Moodle utilises significant resources to implement, including provision of sufficient computers for student use, internet connectivity, and content preparation time and expertise on behalf of the teachers.

Overcoming these barriers is likely to require significant resources. It is not clear whether broken computers in schools can be easily repaired, and if repaired, whether they would remain functional in the medium term. Ensuring a computer, projector, and internet connectivity are available in every classroom would enable delivery of existing EdTech content but would require substantial investment in hardware and infrastructure. Professional development for teachers in delivery of EdTech content will also be needed. It is likely that EdTech approaches which can take advantage of more pervasive and cheaper delivery modes will be more effective in Mongolia. These constraints likely limit the potential of using computers for wide-scale remedial teaching in Mongolia at present (↑JICA, 2019, pp. 43–44), at least in the medium term.

4.3.3. Considerations for mobile interventions

The data suggests that mobile phones are ubiquitous in Mongolia. The Covid-19 pandemic has demonstrated the capacity for mobile education platforms to reach large audiences globally. Mobile education platforms could also facilitate and complement structured classroom learning and remedial learning. A mobile-phone- or SMS-based learning programme could complement and reinforce digital content already developed by MECSS and would be a low-cost intervention with potentially large impact.

Mobile interventions have also been used to accelerate knowledge of foundational literacy and numeracy across sub-Saharan Africa. In Kenya, ↑M-Shule[23] has been delivering personalised maths and English lessons to students and parents at home through SMS. ↑Eneza Education[24] is another Edtech company that offers revision and learning materials through text messages. They have operations in Ghana, Kenya, and the Ivory Coast.

Challenges

While the global community is looking to digital learning, particularly to mitigate the impact of Covid-19 on education, we must note that when such initiatives are evaluated, it is often found that disadvantaged children do not benefit (↑Uwezo Kenya & Kenya, 2020).

For low-income countries, print, radio, and TV, as well as use of non-smartphones seems to be most promising. However, device ownership does not translate into device access, use, or learning. While data from Mongolia suggests that EdTech interventions that utilise television or mobile devices will provide access to the largest portion of households, and importantly provide access to the poorest communities, this is not sufficient. It will be necessary to ensure that children will actually be able to utilise those devices for learning (evidence from Kenya, Senegal, Bangladesh, Ghana, Sierra Leone, and the Philippines).

4.3.4. Considerations for television and the Covid-19 crisis

Access to television is almost universal throughout Mongolia; however, prior to 2020, the use of television to facilitate remedial learning was limited. On January 27, 2020, in response to the emerging Covid-19 crisis, Mongolia ordered the closure of all education institutions until September 1, 2020. As a result, the ↑World Bank (2020d) estimates that over 900,000 students are left with little to no education. All annual and exit examinations for 2020 were cancelled.

To mitigate the disruption to education, UNICEF, MECSS, and the Mongolian television Channels' Association launched TV-based remote learning programmes in January 2020. The ministry has broadcast the daily teacher-led lessons on television since February 2020 for every grade and subject up to secondary school and also made TV lessons and textbooks available on its

[23] https://m-shule.com/

[24] https://enezaeducation.com/#impact

online platform ↑econtent.edu.mn[25] for every grade level from Grades 1–12 at no charge. The ministry has prepared online courses and tele-lessons in several languages, including Mongolian, Kazakh, Tuvan, and sign language. The programme is available to students, parents, and teachers on 16 different television channels with a fixed daily schedule. Since the school closures, 480 online courses and 206 textbooks have been uploaded to educational websites (↑econtent.edu.mn) and so far have reached more than 100,000 overlapping users.

Challenges

For households without access to TV, school instruction has been limited to worksheet handouts provided by teachers on a weekly basis. TV lessons naturally do not include school meals so closures have deprived some children of their most nutritious meal of the day (↑World Bank, 2020d). The programme does not allow for teacher follow-up and it is not clear how learning is being assessed.

We also note that the educational impact on TV programming is an area of active research. Recent evidence suggests that there are moderate learning gains associated with highly engaging programming, such as Sesame Street (↑McIntyre & Watson, 2020; ↑Watson, 2019; ↑Watson, et al., 2020). However, broadcasting basic classroom lessons via TV is usually not interactive and may well not be associated with learning outcomes. In short, TV can be effective, but only if the content is carefully designed.

4.4. Supporting teachers and educators

4.4.1. Promote and focus on student learning outcomes

Regardless of whether EdTech is introduced in remedial programmes or not, the focus of teacher education should be pedagogy that improves student learning outcomes. The ↑Education Endowment Foundation (2018) indicates that non-technology teaching practices have a higher impact at a lower cost than tech-based interventions (↑Haßler et al., 2019i; Haßler, 2020n). In a systematic review of teaching in LMICs, ↑Westbrook, et al. (2013) identified six practices that can have a particularly high impact on student learning:

1. Whole-class dialogue
2. Group work

[25] http://econtent.edu.mn/

3. Questioning
4. Pedagogical content knowledge
5. Code-switching
6. Lesson sequences.

Moreover, the ↑Education Endowment Foundation Toolkit (2018) indicates that feedback, reading comprehension strategies, metacognition, and collaborative learning are highly effective at a low cost (for a review, see ↑Haßler et al., 2019i).

4.4.2. Enhance teacher education to prepare for the use of EdTech

Educational technologies used in the classroom will not automatically generate improvements in student attainment. The impact of EdTech interventions on children's learning is dependent on teachers and educators. Teachers must receive adequate and continuous support to effectively use EdTech, and be supported to adopt (possibly unfamiliar) learner-centred pedagogies. There is also strong evidence that indicates that teachers' qualification levels and continuous teacher education are positively correlated with the likelihood of EdTech uptake (↑Hoyles & Lagrange, 2010; ↑Blackwell, et al., 2013).

To equip teachers to face demands that might be placed on them in the classroom, teacher education sessions need to be focussed on teaching approaches; including teaching approaches that incorporate EdTech (↑Haßler et al., 2019i).

Studies in Mongolia show that digital literacy and use of EdTech among teachers is low. A 2017 survey conducted by the ITPD indicated that only 30% of teachers use ICT in the classroom, citing their unfamiliarity with using EdTech as the main reason. The limited access to EdTech equipment in schools is another constraining factor, despite generally positive views on the introduction of EdTech (↑JICA, 2019).

A study conducted by ↑Li, et al. (2019) determined that a teacher's competency in and perceived benefits of EdTech are significant factors affecting the use of EdTech in Mongolia. The study identified six teacher education areas that would improve the adoption of EdTech among teachers in Mongolia:

1. Professional competency in the educational use of ICT
2. Collaborating with teachers when implementing EdTech

3. Benefits on use of ICT
4. Autonomy to innovate
5. Recognition as a professional
6. Skills and practices in the educational use of ICT.

While it is impossible to improve these areas in the short term, they constitute important medium- to long-term goals.

4.4.3. Prioritise rural teachers

Special consideration needs to be given to rural teachers when providing teacher education. Although most teachers are qualified in Mongolia, the recent mass migration of people from rural to urban areas has affected the capacity for rural teachers to teach. Because there are fewer teachers in remote rural areas, teachers outside urban areas need to be able to teach several subjects (↑Sukhbaatar, 2020, pp. 125–126).

4.4.4. Collaborate with the Institute of Teachers Professional Development (ITPD) and with teachers

To ensure teachers are provided with the support and professional development needed, we recommend MECSS work closely with the ITPD to develop relevant teacher education modules. ITPD provides:

1. Flexibility in training depending on teacher needs.
2. Basic training for capacity development of teachers.
3. Free training in multiple topics.

Basic training is 100 hours in total and since 2015, a web-browser-based online learning system has been introduced to provide the first 50 hours of training.

The Institute uses Moodle to connect teachers with pedagogy-related materials, create online examinations, and participate in discussion forums, among other features. Moodle could be used to develop modules to help guide teachers to conduct remedial education using EdTech. The contents of the online learning platform can be updated with modules specifically designed to help teachers conduct remedial education in literacy and mathematics at all levels of general education.

It is also important to ensure teachers are directly involved in the development of content. With their knowledge, experience, and competencies, teachers are central to any curriculum development effort, including those that involve EdTech. Better teachers support better learning because they are most knowledgeable about the practice of teaching and are responsible for introducing the curriculum in the classroom (↑Alsubaie, 2016). On the other hand, EdTech development has to consider the teacher as part of the environment that affects the curriculum (↑Carl, 2009). Hence, teacher involvement is important for successful and meaningful curriculum development. Teachers being the implementers are part of the last stage of the curriculum development process.

Challenges

As noted above, the widespread use of Moodle requires assessing and likely improving the provision of ICT facilities for teachers. It also requires teachers to have ready access to a computer and the internet, which may prove to be a significant constraint. Moodle also has relatively limited offline features, and studies have shown that online platforms and MOOCs are not being used by a large proportion of users (↑Rohs & Ganz, 2015; ↑Liyanagunawardena, et al., 2013). Clear evidence on extensive usage of Moodle among teachers in Mongolia is required.

4.4.5. Work with parents and caregivers

In Mongolia, where a key target population for remedial education likely includes children from nomadic families with low levels of literacy, sensitising parents to any intervention is crucial. There is strong evidence that parental and sibling involvement can have a significantly positive impact on the levels of learning achievement in young children (↑Gertler, et al., 2008). Parental and caregiver understanding and attitudes towards technology influence their children's uptake of EdTech and use of technology (↑Li, et al., 2019, pp. 85–99).

4.5. Tracking students in remedial learning programmes

An important aspect of remedial learning is to ensure that teachers can monitor the progress of students. In personalised learning approaches (such as 'Teaching at the Right Level'), collecting monitoring information is a key ingredient for success. This is because data can be used to understand learning levels and adjust content appropriately (↑Teaching at the Right Level, 2020).

This could potentially be extended by enhancing the existing Education Sector Information System (ESIS) to provide capacity to develop and share teacher plans and student data and to provide feedback to parents and students and help track student performance. It can also be used to identify students who are at risk of dropping out of school because of poor attendance or grades and to develop tools to enable teachers to better monitor students undertaking remedial learning. Mongolia is also piloting parent access to ESIS data. The pilot will allow parents to track the progress of their children at school via mobile phones and communicate with teachers and the school principal. This can help ensure children are assisted in their learning through greater parental engagement.

4.6. Integrating with the national curriculum

A study by ↑Hirsh-Pasek, et al. (2015) found that remedial programmes incorporating EdTech must be integrated with the national curriculum for it to have the greatest influence on learning outcomes. ↑Kibukho, et al. (2014) compared three separate EdTech interventions in the Kenyan education system. The author did not find statistically significant differences between tablet use among teachers, tablet use among instructional supervisors, and the use of e-readers among students. The one consistent feature of the interventions was that they were aligned to the national curriculum. The ↑Kibukho, et al. (2014) study concluded that, as well as the need for teacher training to optimise integration of EdTech, the government must "address ICT as an instrument of teaching". When teachers do not perceive that expected uses of technology are closely aligned with the curriculum they are less likely to use it (↑Valiente, 2010).

The curriculum of the compensatory programme under the 'Improving Primary Education Outcomes for the Most Vulnerable Children in Rural Mongolia' project focused on ensuring children had the basic literacy and numeracy skills at the standards set by the government for Grades 1–3. The curriculum was built on an existing non-formal education curriculum developed by the National Center for Non-formal and Distance Education (NFDE) in Mongolia. Lessons from other education authorities specialising in non-formal distance education programmes in other countries (e.g., USA) were also incorporated (↑World Bank, 2011).

4.7. Providing teaching and learning materials to support remedial education

The development of remedial supplementary teaching materials for literacy, numeracy, science, and other subjects is identified as critical for remedial education in Mongolia. The supplementary teaching materials should be aligned with national curricula but should also be appropriate for learners requiring remedial learning. Although MECSS have digitised textbooks, there is a need to develop suitable interactive materials to engage students by using videos, animations, and simulations, and which adapt to a child's learning pace. The ministry is planning development and improvement of digital learning materials and there is scope to provide assistance to ensure they are suitable for remedial learners. These must be made compatible with teaching plans suitable for the curriculum and enabled for delivery over platforms that are accessible to most people, such as mobile devices.

5. Summary

This note highlights that when remedial interventions are well-designed, they can yield fast and significant improvements in core competencies (↑McLaughlin & Pitcock, 2009; ↑Schwartz, 2012; ↑Longden, 2013; ↑Banerjee, et al., 2016). Effective remedial interventions are learner-centric and provide adequate professional development support to educators. Moreover, they 'teach at the right level' — responding to children's actual achievement levels and their needs (assessment for learning). Technology-supported remedial learning programmes appear to offer further opportunities to improve learning outcomes partially because they offer further personalisation. However, technology support is difficult to realise unless there is reliable existing infrastructure (↑Haßler, et al., 2020i).

Before any decision on the use of EdTech is made, decision-makers should sequentially explore:

1. What are the needs of the learner?
2. What are potential interventions to those needs?
3. What role might technology play?

The process outlined in the EdTech Hub Helpdesk Response on virtual learning environments discusses such explorations (↑Adam et al., 2020). Mongolia can benefit from its strong EdTech infrastructure to enhance the effectiveness of remedial learning programmes. Lessons from former after-school, compensatory, and equivalency programmes can be used to determine potential delivery modalities. Existing technology such as mobile phones and computers can offer options to deliver computer-assisted learning features to accompany remedial interventions; however, for this potential to be realised, considerable investment in upgrading hardware and software will be required. It is therefore unlikely that technology-supported learning can be realised in the short term.

Television is very pervasive throughout Mongolia and the poorest families generally have access to this medium. During the Covid-19 crisis, MECSS moved quickly to make all textbooks available online and to deliver classes broadcast over the national television network. However, it is as yet unclear as to whether this approach has enabled students to learn and thrive. It appears that tailored programming for children (such as Sesame Street) may be associated with higher learning gains than lectures. A number of reports and publications on educational television are available (↑McIntyre & Watson, 2020; ↑Watson, 2019; ↑Watson, et al., 2020; ↑World Bank, 2020c; ↑Watson, 2020)

It is also important that both the learners and the teachers receive training and ongoing support in the technology applied. EdTech should be implemented within the framework of accredited curriculum and teacher competency. This will help reduce capacity development needs when implementing new EdTech solutions.

Robust analysis of the cost-effectiveness of proposed EdTech interventions will be needed. It is also unlikely that without strong teacher support any remedial programme will result in effective remedial learning for students who may be struggling or falling behind (↑Major & Francis, 2020). The use of EdTech should be complemented by robust professional development for teachers in remedial education. Strong monitoring of students' use, learning progress and outcomes, as well as face-to-face follow-ups with students on learning issues would be required. Strengthening the capacity of management tools such as ESIS to monitor student learning outcomes and feed information back to teachers would also facilitate remedial education using EdTech.

EdTech provides many opportunities to engage students through remedial learning but it needs to be balanced with effective teaching and student engagement. Human relationships and interactions are vital to the learning process, including guiding and monitoring children's development.

6. Additional resources on remedial programmes relevant to Mongolia

↑UNESCO IITE (2020). *Handbook on Facilitating Flexible Learning During Educational Disruption: The Chinese Experience in Maintaining Undisrupted Learning in COVID-19 Outbreak*. Beijing: Smart Learning Institute of Beijing Normal University.

During the Covid-19 outbreak, the Chinese Ministry of Education launched the 'Disrupted classes, Undisrupted Learning' initiative, providing flexible online learning to over 270 million students from their homes. This handbook aims to define the term 'flexible learning' with examples of case studies. It describes several flexible online learning strategies implemented during the Covid-19 outbreak. These strategies are presented based on six dimensions, namely,

1. Infrastructure
2. Learning tools
3. Learning resources
4. Teaching and learning methods
5. Services for teachers and students
6. Cooperation between government, enterprises, and schools.

The handbook aims to help other educators, researchers, and practitioners implement similar case studies in their context.

↑World Bank (2017b). *Pre-Primary Education in Mongolia: Access, Quality of Service Delivery, & Child Development Outcomes.*

This document details the final outcomes of the World Bank Global Partnership for Education (GPE) Fund Grant in the Amount of USD 10 Million to Mongolia for an Early Childhood Education Project. The project piloted the use of mobile learning facilities, primarily in early childhood education, to facilitate access to education for children of nomadic families in rural areas. The project did not implement EdTech but does demonstrate the potential for mobile learning facilities to support education delivery to nomadic and rural communities. Mobile schools can potentially be expanded to facilitate remedial and consistent learning opportunities for children of nomadic families.

↑Li et al. (2018a). Understanding factors affecting primary school teachers' use of ICT for Student-centered education in Mongolia. *International*

***Journal of Education and Development using Information and Communication Technology* (IJEDICT), 2018, Vol. 14, Issue 1, pp. 103–117, Tokyo Institute of Technology.**

This study aims to understand the factors affecting teachers' perceptions on the use of ICT for student-centred education. Based on Fullan's educational change theory, the analysis through multiple linear regression and focus-group discussion was conducted on 838 primary school teachers in Mongolia. This found that teacher's professional competency and perceived benefits on the use of ICT are significant factors affecting teachers' perceptions on the use of ICT tools for student-centred education. Furthermore, it suggests that teachers' professional competency, perceived benefits on the use of ICT, and teacher cooperation are affecting teachers' perceptions on the use of digital contents for student-centred education.

↑Li et al. (2019). *The Influence of Teachers' Professional Development Activities on the Factors Promoting ICT Integration in Primary Schools in Mongolia. Education Sciences.*

This paper examines the influences of professional development activities on important teacher-level factors that are important for the use of ICT in education for primary school teachers in Mongolia. The study result shows that six teacher-level factors that are important for ICT integration have been improved over time through professional development activities. These are:

1. Professional competency in the educational use of ICT
2. Collaboration for ICT integration
3. Benefits on the use of ICT
4. Autonomy to innovate
5. Recognition as a professional
6. Skills and practices in the educational use of ICT.

This provides supporting evidence to educational practitioners for the implementation of effective professional development programmes to promote ICT integration in education, especially in the context of Mongolia.

↑JICA (2019). *Data Collection Survey on Possibilities of Educational Support with ICT and Japanese Companies Promotion in Mongolia*. Japan International Cooperation Agency.

This document provides comprehensive information concerning ICT use in education in Mongolia and explores the possibilities for further implementation of EdTech in all contexts throughout Mongolia. The document focuses on the following three aspects:

1. Online teacher training for remote areas.

2. Improvement of teaching skills for science (teaching skills for conducting experiments) as well as mathematics.
3. Possibility of collection and analysis of big data towards curriculum development.

↑Carlson (2013). *Using Technology to Deliver Educational Services to Children and Youth in Environments Affected by Crisis and / or Conflict*. Final Report. USAID.

This paper examines the use of EdTech in challenging environments. It compiles and reviews case studies demonstrating the utilisation of technology-supported interventions to deliver education services that promote equitable access to children and youth in challenging environments such as those affected by crisis and / or conflict. As such, it provides case studies of the use of EdTech for remedial education and recommendations for the design and implementation of technology-supported education interventions. The intended audience is education programme planners in developing countries, particularly those affected by conflict or crisis.

↑Pouezevara (2015). *Revisiting the 'm' in m-learning: Making the most of mobile environments for teaching and learning in developing countries.* Association for the Advancement of Computing in Education (AACE).

This paper examines innovations in developing countries that are leading to increased use of mobile devices to deliver mobile learning content. It draws on a broad review of existing m-learning programmes to illustrate how instructional strategies are being employed. It explores whether these strategies are appropriate for learners in these contexts. It urges the reader to think differently about the 'm' in m-learning and move the conversation away from broad notions of mobile learning for any and all purposes, to more detailed guidance on how to implement mobile learning.

↑Omidyar Network (2019). *Scaling Access & Impact: Realizing the Power of EdTech*. March 24, 2019.

This series of papers examines initiatives in Chile, China, Indonesia, and the USA that demonstrate how EdTech reached a broad spectrum of students. The article focuses on initiatives that improve teaching and learning at scale but also examines the capacity for each initiative to advance equitable, high-quality education for all learners regardless of their location and socio-economic status. The examples demonstrate the capacity of EdTech to support remedial and remote learning. The example of China demonstrates the implementation of EdTech strategies using different platforms in a country with regions sharing similarities with Mongolia.

↑Li et al. (2018b). The Influence of Interactive Learning Materials on Self-Regulated Learning and Learning Satisfaction of Primary School Teachers in Mongolia. *Sustainability.* 10, 1093.

The purpose of this study was to investigate the effects of interactive learning materials on learners' self-regulated learning processes and the learning satisfaction of primary school teachers in Mongolia. Five self-regulation processes were identified in this study:

1. Internal motivation
2. Motivation for better assessment
3. Planning and organising skills
4. Critical and positive thinking skills
5. Effort regulation.

The results of this study can help inform approaches to self-learning and remote learning for teachers in primary education in Mongolia.

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