A Literacy Practitioner’s Guide to Education Technology Guidance:
AMPLIFYING THE ROLE OF TECHNOLOGY TO REACH UNDERSERVED POPULATIONS
Acknowledgements

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Introduction

When confronting the challenge of global literacy, technological solutions appeal as a simple option for reaching broad audiences. Digital solutions are increasingly popular in the literacy field and offer the opportunity to reach underserved populations like adults, those with low-resources and connectivity, and people with disabilities. Yet, without careful considerations for the unique needs of these populations, digital solutions will not be able to adequately address the challenges of illiteracy.

Recent UNESCO estimates show that there are over 750 million adults who lack basic literacy skills¹ and more than 617 million children and adolescents are not achieving minimum proficiency levels in reading and mathematics.² Some may debate the methods for measuring these skills or estimating the size of the problem, but the individual, intergenerational, and societal consequences of illiteracy are undeniable. Impacting health, education, and economic outcomes, illiteracy has cost the global economy $1.2 trillion (USD) annually³. These costs are not confined to low- and middle-income countries; high-income countries suffer from illiteracy, too.

Illiteracy is often understood as the inability to read or write. Of equal or perhaps greater concern is the concept of functional illiteracy, where an individual may have limited skills but cannot apply them to make informed choices necessary for effective and productive performance—for themselves, their families, or within society.

This definition, and the concept of functional literacy, are integral to United Nations Sustainable Development Goal 4, which seeks to “ensure that all learners acquire the knowledge and skills needed to promote...sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development” by 2030.⁴

**Why is technology important to literacy?**

Technology, especially mobile technology, has become an indispensable part of life in most parts of the world. Over 5 billion people were connected to mobile services in 2017, and that number is expected to reach 5.9 billion

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¹ UNESCO Institute for Statistics,
² UNESCO Institute for Statistics,
³ World Literacy Foundation, The Economic & Social Cost of Illiteracy (September 2015)
by 2025, equivalent to 71% of the world’s population. Expected growth will be driven by developing countries in Asia as well as Sub-Saharan Africa and Latin America,\(^5\) where nearly two-thirds of the those lacking literacy skills live.

We believe that technology can be an especially useful tool for improving the teaching and learning of literacy, given that we live in an “age where literacy practices are increasingly mediated by digital technologies.”\(^6\) Education technology can support literacy attainment by:

- Providing options to aid teachers in imparting knowledge and getting feedback
- Helping learners process and express their understanding using interactive tools, design options, multiple output formats (audio, video, etc.)
- Personalizing education and addressing previously underserved needs
- Connecting learners and communities in new ways
- Providing content and enabling practice on-demand, anywhere
- Reinforcing and supporting traditional instruction
- Packaging literacy lessons with other essential life and work skills

Educational technologies must be intentionally designed for their target audiences and delivered in a manner that meets their specific needs. This paper explores three areas where the design and delivery of technology-based interventions require particular attention overcome barriers to their use and effectiveness. We address three populations requiring additional consideration for implementing digital literacy solutions: adults, low resources and connectivity settings, and neurodiverse and vision impaired populations. In each section, we seek to help developers identify and overcome barriers in creating tools to ensure “individuals to achieve their goals, develop their knowledge and potential, and participate fully.”\(^7\)

**Objectives**

Guidance for for developers and education technology practitioners can often be generic or fail to address key populations, settings, or topics of interest. Information and products may be disaggregated, making it difficult for technology and literacy practitioners to easily find targeted information useful in their practice.

This guidance document seeks to help fill that gap by bringing together ideas from existing guidance and adding a practical, practitioner-informed literacy lens. In this document, we draw on many existing guides and products including the:

- Principles for Digital Development
- UNESCO-Pearson Guidelines for Designing Inclusive Digital Solutions and Developing Digital Skills
- CAST CISL Demo and Worldshare BookReader

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\(^5\) M. Sivakumaran and P. Iacopino, The Mobile Economy 2018, GSMA


By referencing these guidelines and adding the practical experience of developers, we can provide practical guidance for others seeking to develop, leverage, or support educational technology for literacy development, improving the supply and demand of more universally-accessible literacy products. This guidance document aims to:

1. **Raise awareness of existing guidance available** for developers and users of technology-enhanced literacy tools
2. **Build upon the existing education technology guidance** to make it more actionable for literacy-focused practitioners and their networks
3. **Build upon existing education technology guidance** to be more literacy-focused, practitioner-informed, actionable, and relevant for key populations and settings

**Theory of Change**

**We recognize that**
- Large swaths of the world’s population are illiterate and not fulfilling their potential
- Technology has the capacity to improve teaching and learning for literacy

**However,**
- Existing literacy tools do not meet the needs of all populations & settings, including,
  - Adults
  - Low resource and connectivity settings
  - Persons with disabilities
- Guidance exists but is often
  - Not literacy-focused or practitioner-informed
  - Disaggregated or difficult to access

**But, if we can**
- Raise awareness of and facilitate access to existing guidance, and
- Tailor the guidance to be more:
  - Actionable for developers and their networks,
  - Literacy-focused
  - Relevant to key populations and settings

**Then, we will**
- Ensure that more relevant technology and content is generated, supported, and demanded
- Serve more people and settings
- Improve literacy outcomes globally

**How to use this guide**

The guidelines and practitioner examples presented here are intended to inspire you to critically engage with the tools you develop, support, fund, or need. They can be used to plan for and develop new tools or reflect on the tools you and your partners already use. These guidelines should be considered inclusive of all types of technology and the transfer of digital content. We do not endorse or favor one delivery channel or another and hope that these guidelines are applicable to any technology used in your setting. Finally, at the end of this document is a summary of other key resources for further reading.
The Breadth and Depth of Illiteracy Among Adults

One of the greatest global challenges of our time is eliminating adult illiteracy. Over 750 million adults in the world, two-thirds of whom are women, are unable to functionally illiterate. Adult literacy rates remain especially low in regions where a lack of access to schooling, early school leaving, or poor quality of education exists. Southern Asia is home to close to half of illiterate adults while a quarter live in sub-Saharan Africa. However, adult illiteracy impacts all regions. In the U.S., one in six adults are illiterate and 100 million lack foundational skills. With improvements in assessing proficiency and broadening definitions of literacy, we are increasing our understanding of the breadth and depth of the problem.

The ripple effects of adult illiteracy are well known: a mother’s literacy level is the greatest single influence on her child’s future formal education success. Compounding this intergenerational challenge are the greater ramifications of adult illiteracy. Functional literacy in one’s first language is considered a critical building block for gaining other essential lifelong skills. Illiterate adults often face higher rates of underemployment and unemployment and lower wages, which decreases their ability to be productive contributors to their national economies. Adult illiteracy also correlates to poor health outcomes, with less access to ongoing healthcare.

Barriers and Challenges

There are multiple challenges to meeting the needs of adult learners that stakeholders working with this population needs to be aware of and account for.

- The overwhelming majority of these learners is not in, nor will they have access to, a formal educational program.
- Adult learners have competing need for their time, including work and family obligations, that may have priority over their own education. As such, developers must find ways to make their solutions fit into the busy lifestyles of these learners.
- Those in need of services often face financial constraints for spending on their education, whether it be for content, mobile minutes or internet access. Consideration must be given to the cost of the proposed solution and whether the individual learner or partners will make it affordable.
- The audience may lack digital literacy skills, so technology developers must consider how adults are already accessing and using mobile technologies.

Developed Countries Also Face Challenges Educating Adult Learners

- Despite a ubiquitous system of public education for youth and adolescents, 36 million adults in the U.S. cannot read, write, or do basic math above a third-grade level (OECD, 2013)
- At the present levels of public funding, less than 10% of non- and low-literate adults are receiving services (OCTAE, 2017; WIQA, 2018)
- Per pupil spending was just $1,021 per adult compared to $13,814 for public school children.
- Formal programs have proven inefficient, with as few as 38% making measurable skills improvements annually. (AIR, Diving Deep Into the Local NRS Pool: Attendance, Educational Gain, and Transition Outcomes, May 2010)
In addition to the aforementioned barriers to the use of technologies, it is equally critical to recognize that adult education approaches significantly differ from those for children and adolescents. Accordingly, we urge developers to remain vigilant in creating tools specifically designed for this audience. As mentioned previously, adult learners are not likely to be in an educational setting, so developers must consider how and where the teaching and learning will take place. Adult learners acquire literacy skills differently than children, so the pedagogical approach should reflect what the learning sciences informs us are best practices for this audience. Similarly, developers need to ensure that their curriculum and content materials are age appropriate and reflect the experiences and cultural norms of adults, and don’t simply port over content that was developed for younger learners or from different cultures.

How educational technologies will help alleviate adult illiteracy

With less than a 6% chance for low literate adult learners to reach a classroom, teacher, or other forms of in-person literacy instruction, how might solutions reach the scale of need? We believe the answer lies in technology-enabled tools, predicated on the facts that millions of learners already own devices and that developers can build educationally rigorous yet cost-effective means to deliver engaging learning content.

Technology-enabled literacy tools - when designed for the need, context and populations they serve - can address adult illiteracy by increasing:

- **Equity:** The ability for all adults to access high-quality, contextualized educational opportunities anywhere in the world.
- **Accessibility**: The availability of online and mobile learning designed to address access barriers. While 66% of people use mobile phones, only 43% have access to the internet. Offline, messaging and other solutions are bridging gaps. In addition, the availability of apps, devices, materials, and environments designed to support and enable access to content and educational activities for all learners, regardless of learning ability.
- **Affordability**: The commitment to consider cost, price sensitivity and other barriers to access for most adult learners when designing a solution. With the decreasing cost of increased functionality, for example, smartphone ownership rates in sub-Saharan Africa, which stand at 33%, are expected to double by 2025. Furthermore, mobile broadband connections are expected to grow to 87% of the population in this region. Information and communication technologies can also be more price effective compared to print materials (e.g., the costs to replicate and update worksheets) or place-based expenses for running in-person literacy and other outreach-related programs.
- **Relevance:** The ability to meet illiterate learners wherever they are at given the barriers (e.g., transportation, access to centers, lack of childcare, work demands) they face to access lifelong learning opportunities.

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14 OECD, 2013
15 Note: A broader definition of accessibility is used in the other section to include ensuring access for those with additional learning needs.
16 GSMA, 2018
17 NETP, 2017 update at p. 5
18 Pew Research Center, 2018
19 GSMA, The Mobile Economy Sub-Saharan Africa, 2018
Source Guidelines
As we have stated previously, there are numerous sources available to solutions developers, program administrators, and funders that provide guidance for solutions development, including technology-enabled ones. After reviewing several of these guides, we have chosen to add our lens to one in particular—From Principles to Practice: Implementing the Principles for Digital Development—because it is the culmination of rich and detailed discussions by more than 500 individuals representing over 100 organizations working in international development and were designed to help integrate best practices into technology-enabled programs. The Digital Principles were first created in consultation with organizations such as The Bill and Melinda Gates Foundation, the Swedish International Development Agency (SIDA), the UN’s Children’s Fund (UNICEF), UN Development Program (UNDP), the World Bank, and the U.S. Agency for International Development (USAID), and the World Health Organization (WHO). As these nine guidelines were intended to be updated and refined over time, we feel it is appropriate to add our experience and knowledge from the field to them and this guide is that result.

Principles for Digital Development
1. Design with the User
2. Understand the Existing Ecosystem
3. Design for Scale
4. Build for Sustainability
5. Be Data Driven
6. Use Open Standards, Open Data, Open Source, and Open Innovation
7. Reuse and Improve
8. Address Privacy & Security
9. Be Collaborative

We selected the five most relevant guidelines for developers and literacy practitioners focused on adult learners. Ultimately, the aim of tech-enabled adult literacy solutions is to reach the scale of need in a contextualized, appropriate, effective, and long-term sustainable way. We believe the following guidelines are effective tools for doing so.

1. Design with the User
Learner-centered or co-created design describes the process by which the end user or beneficiary of a tech-enabled learning solution is involved in its design. Without considering the individual’s unique socio-economic, cultural and contextual factors that influence their daily life, it’s near impossible to design for their actual needs. The user’s input serves as a necessary gauge to whether the solution has its intended effect. And more importantly, it helps avoid the negative unintended consequences of a literacy intervention.

“Design-test-iterate” - or continuous improvement - is one model that helps ensure that users are considered at all stages of development. Discrete stages, with specific goals and timelines allow feedback and formative research to be incorporated throughout the process.
Design – Test - Iterate

- **Understand**: Better understand the illiteracy challenge from the user’s perspective.
- **Ideate**: Convene appropriate representatives (e.g., users, community members, subject matter experts, product and program creators) to propose appropriate solutions.
- **Prototype**: Create and test a prototype of a potential solution.
- **Test**: Gather feedback on potential solution through observation and interviews.
- **Iterate**: Insights gained from testing improve the solution in iterative cycles, which are repeated throughout the life of the program. This is also known as “continuous improvement cycle”.

**Pro tip:** For mobile-first solutions, engaging, relevant, short lessons (e.g. audio recordings of local storytellers retelling real life situations) are ways to keep the interest of busy adults who also happen to be illiterate.

**Pro tip:** This process doesn’t happen overnight. Trial, error and humility on the part of all parties involved are needed to co-create a literacy solution that works for people in particular places facing unique challenges.

**Pro tip:** Understanding whether a illiterate adult has participated in a literacy course is important when designing the literacy solution. Illiterate adults who have taken a literacy course in their lifetime require a different approach than those who have never partook in literacy program.

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**Co-create solutions with initial and ongoing feedback from users**

*Cel-Ed* has applied this principle from start to finish in the design of its mobile skills and literacy program. The company embarked on a two-year randomized control trial (RCT), conducted UX/UI experience assessments and ran pilots for its early stage solution. This robust process led to a Cell-Ed platform where learners either place a voice call and/or text on a feature or smartphone or download an app to access content (from literacy to job skills courses) and coaches (live and automated) anytime, anywhere with no internet needed. Learners continue to be at the center of Cell-Ed by providing real-time feedback through interviews and surveys to capture insights that drive iterative solution improvements. This feedback, as well as data on utilization, progress and outcomes are visible through Cell-Ed’s reports and dashboards. Read more of [United Nations Case Study on Cell-Ed](https://www.un.org), 2018.

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### 2. **Understand the Existing Ecosystem**

Understanding the ecosystem where the adult literacy tech-enabled intervention will take place is crucial to ensure its successful implementation and long-term sustainability. This requires an analysis of the existing infrastructure, market, politics and culture, and people.

**Infrastructure**: Existing infrastructure is key to determining technology interventions. Key factors to consider when selecting the appropriate technology include access to electricity and mobile network coverage, which can also influence how data is collected, stored and used (see the section on [Low Resource and Connectivity Settings](#) for more detail). Other considerations include the rates of mobile phone ownership, internet connectivity, and the digital skills of the target audience.
• **Limited internet connectivity requires a solution that enables offline content delivery.** Offline solutions are particularly important for adults who may be in different locations throughout the day with unsteady service coverage.

• **Mobile phones are a great tool for adult learning.** Cellphone penetration is high among adults, and basic phones, feature phones or low-end smartphones, even those without internet connection, can still serve as meaningful learning platforms by delivering content through SMS, interactive voice response (IVR) or lightweight mobile websites (for internet-enabled devices).

💡 Pro tip: Adult-literacy interventions, should incorporate digital skills training to ensure that the low literate target audience is comfortable with using technology for their learning.

**Market: Local markets influence the availability of services in a particular geography.** More importantly, markets determine the economic opportunities for everyone, including individuals with limited or no literacy skills. Knowledge of the local market is important when it comes to:

- **Determining the type of technology for the intervention**, taking into account the price and availability of technology locally. If hardware is required for the intervention it is preferable to acquire it locally to avoid shipping, maintenance and import duty costs.

- **Developing or procuring learning materials in local languages or context**: Learning materials in local languages or context is crucial for the success of the adult literacy intervention.

- **Deciding on the type of intervention and the target audience**: Often the best way to motivate working illiterate adults to participate in a literary course is by convincing them that improved literacy will lead them to better economic opportunities.

💡 Pro-tip: Motivating adults to learn requires content that is perceived relevant and useful for their job, family or local community.

**Politics and Culture:** Politics and culture influence not only whether the intervention takes place but also how and under which circumstances. Understanding national literacy strategy, existing organizations, local laws, regulations and customs are key to developing and running a successful digital adult literacy intervention. It’s critical to acknowledge existing policies and regulations, cooperate with local organizations and institutions, and consider local traditions and customs.

**People:** Local traditions and customs are often strongly embedded in communities with lower literacy rates. Therefore, it is important to:

- **Sensitize local leaders on the issue of adult illiteracy and your intervention.** In many communities, local leaders can further inform you of the community needs and their active involvement has shown to be very effective in ensuring continued support for the project. This is particularly important if the intervention requires hardware that will remain with the community and helps to ensure the hardware is not stolen or misused.

- **Address taboos around adult illiteracy.** Illiteracy for many adults is a source of embarrassment and leads to them not attending adult literacy classes due to the fear of being seen in them. This is where technology, and in particular mobile technology can be very helpful and ensures the privacy required for adults to feel comfortable as they are taking a literacy course on their phone. Therefore, it is crucial to ensure that the privacy of adults participating in the digital adult literacy intervention is safeguarded.
• **Understand local customs that may be commons such as oral and storytelling in low-literacy environments.** This understanding can help determine what type of adult literacy intervention to adopt and mitigate engagement challenges. For example, in many smaller communities the Freirean approach to teaching literacy to adults have proven to be more effective than the ‘traditional classroom model’.

### Understand the people

In 2015-2017, Worldreader, Results for Development (R4D) and Pearson’s Project Literacy partnered to develop and implement a digital reading pilot called Read to Kids for parents of young children among under-resourced households in Delhi State. Addressing the existing multi-lingual and low-resource ecosystem, the partnership developed the Worldreader Kids app3, a digital collection of 550 storybooks in Hindi and English. One unexpected outcome of the pilot was that women reported improved digital literacy, as they read to their children more frequently. By crafting a solution for the specific language and low-resource context in Delhi State, Worldreader Kids app3 was able to fit the needs of its target community, leading to even more benefits than expected.

### 3. Design for Scale

According to the Principles, “designing for scale means thinking beyond the pilot and making choices that will enable widespread adoption later, as well as determining what will be affordable and usable by a whole country or region, rather than by a few pilot communities.” This is an important concept considering that 750 million adults worldwide remain illiterate. Piloting interventions in the handfuls worldwide will not meet the scale of need. By designing for scale from the beginning, your initiative can be expanded more easily to other users across markets, regions, countries and even globally.

Developers and literacy practitioners can also think about scale from other dimensions, including:

- **Information Communication Technology (ICT) design** is important to consider upfront if your intended outcome is reaching the scale of need locally, regionally, and beyond with a relevant, affordable and accessible intervention. Questions to ask:
  - Is the product downloaded? All at once or enough to create interactivity with the online data? All online? Will users be able to download the product in low-bandwidth settings? Are there plans that accommodate regular usage costs?
  - What are the requirements of the device to use the product? How much memory or processing speed does it require? Does it require the most recent devices that may not be ubiquitous or exceed the price users can pay?
  - How many users can be on the product at once? Does that slow the response time of the product?
  - Where servers are located for response time, load balancing on server(s)?
- **Localization**: Can the product be used in a given locality, region, etc.? How will this be accomplished? And what are the difficulties and costs of those product modifications? Considerations include language, culture, etc.
- **Operations**: How many team members are necessary to service users at scale? What hours do they need to work? What languages need to speak to match/support the user base? Real-time support or responsive over time?
4. **Build for Sustainability**

With a deeper understanding of the users and ecosystems for the proposed literacy solution at various scales (e.g., local, regional, global), designing a sustainability plan upfront is key to long-term livelihood of a literacy solution. As we seek to advise developers making new products for a marketplace, the notion of building in “sustainability” from the outset of the project is critically important.

Since illiterate adults generally lack income and digital skills, we cannot assume that they will be able to pay for some or all of the tech-enabled literacy solution. Therefore, when developing a scaling sustainability plan, it is advisable to explore alternative “exit” strategies and make strategic technology choices, which include:

- **Local adoption.** A viable alternative could be ownership transfer to local stakeholders such as the government or local organisations. Engagement with local stakeholders is a recommendation mentioned in guideline #2, which should be considered during the design stage of the intervention. Researching local stakeholders and engaging with them at this stage is recommended, with the potential to continue to collaborate or even fully transfer intervention to local partners.

- **Choice of the technology.** As adult literacy programs usually target working-age adults, **mobile phones** are a logical choice for long-term sustainability, especially when considering that many illiterate adults already own a mobile phone. For those who do not, they are likely to purchase one upon the acquisition of literacy skills. Additionally, mobile phones are a portable technology that users have access to at all times, which enables the flexibility they require in their busy lives. Finally, mobile phones provide privacy around what users are learning or reading on their phone. Privacy is an important element of the adult learning process as it prevents the anxiety and the feeling of embarrassment that can accompany not being able to read or reading books with lower reading levels (e.g., children’s books) when practicing.

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**Reinvigorate existing literacy platforms with new technologies**

In 2014, Worldreader partnered with the Kenyan National Library Service, the Bill & Melinda Gates Foundation, and eight local Kenyan libraries to create **Project LEAP (Libraries, E-reading, Activities, Partnership)**. The program deployed 3,000 e-readers into public libraries, intending to increase patronage. The initiative successfully improved public library attendance, including adult patrons. After the introduction of e-readers, the proportion of adult patrons rose from 16% to 25%, likely because these new and exciting technologies encouraged adults to visit the library to “see what the fuss was about.” By partnering with existing local institutions, Worldreader was able to reach a broad audience in a sustainable manner.
5. **Be Data Driven**

Assessing the efficacy and effectiveness of a technology-enabled literacy solution can greatly depend on the quality of data gathered and insights generated. Evidence is critical to consider at all stages of a tech-enabled adult literacy solution. Real-time data and ongoing feedback can ensure you effectively and efficiently reach and teach the greatest number of learners. There is a multitude of ways to capture evidence when, how, where and for whom an intervention works. By way of example, given the prevalence of mobile phone-based interventions, telemetry data is constantly captured and reported in the background, so that it becomes more of a design question of how that data will be segmented, sorted and used rather than how it is captured. When designing a solution, consider ways to capture data passively, actively and using mixed-methods to inform ongoing outcomes and potential impacts of the solution.

- How will data be used to create a feedback loop to the user? Will it be in real time and transparent to the user or used at discrete intervals for review? Can it be used to make the product “adaptive” to their needs, based on their own usage?
- What information is necessary to help make “informed interventions” by educators, facilitators and the like? Will it not only inform but also guide their actions? How will that data be delivered to them (dashboard, text)?
- How will data be used to measure outcomes? Whether meeting an external standard or trying to measure competency, how is that measured and what data is required to show compliance or mastery?

💡 Gathering data from multiple sources is key to gauging effectiveness and meeting the needs of illiterate adult learners. The power of partnerships is key here where data and insights can be collected from learners and organizations at all levels to validate and enhance findings gathered from technology interventions.

### Using data to encourage adult learners

Learning Games Studios, a US-based educational technology company, wanted to find a way to encourage and engage adult literacy learners. They created *Xenos*, a playful, social language learning game that features English language and literacy skills in a virtual world of missions and adventures. As learners progress through the game, *Xenos* reflects their improvement through increasingly challenging levels. Because success in the games is congruent with mastery of skills, students will have continuous feedback on their progress through the scoring within the games and the missions completed, and consistent goals for future achievement that are personally challenging but within reach.
LOW RESOURCE AND CONNECTIVITY SETTINGS

Introduction
Literacy represents the foundation for achieving our highest potential as humans. Improved literacy can contribute to diverse positive outcomes: economic growth, greater opportunity for employment, reduced poverty and crime, increased civic engagement, and enhanced cultural diversity through literacy programs in minority languages. Being literate means better health through information provision on best practices and prevention methods.

These benefits of literacy ensue only when all barriers have been removed, ensuring smooth and ready access to quality literacy resources. For those in low resourced and connectivity (LRC) settings, barriers to access continue to be a great challenge. People lacking reading and writing skills are more likely to be unemployed, without the resources or support for educational technology solutions. Technology-enhanced literacy tools relying on expensive devices or fast, stable internet connection remain inaccessible to the most vulnerable populations.

Barriers to improved literacy in low resource and connectivity settings
The barriers to improved literacy in LRC settings affect low, middle, and high-income countries. They can be financial or structural. These barriers include:

- **Insufficient infrastructure**
  - Limited or unstable electricity
  - Limited or unstable internet coverage
- **Lack of access to literacy resources**
  - High cost of materials, technology, and data
  - Content relevance for various contexts
  - Low awareness about the availability of solutions

Increasing technology penetration: Hope for the future
Access to educational technology increases as energy, internet, and device technology improves. Developments in the energy sector, including more powerful, longer-lasting batteries and renewable, off-grid energy sources, like solar panels, allow electrical power to reach previously unserved populations. Over half of the world’s population, 55 percent, has access to the internet, and use continues to increase, with Africa leading the average annual growth at 27 percent. Mobile phone ownership grows as well: eight out of ten people in low- and middle-income countries own a mobile phone, with even more having access to one through household device sharing. Similarly, as the cost of computers and mobile phones continues to fall, affordable educational software and platforms will become more accessible, offering literacy resources and hope to millions.

Until that point, however, LRC settings remain a challenge for educational technology solutions. Well designed and deployed technology can overcome the challenges of low resource and connectivity settings, serving as useful tools for improving literacy education and practice. Designed appropriately for LRC settings, literacy programs,
platforms and services using these devices and technologies have the ability to personalize education, meet new needs, connect learners and local communities, and provide content and practice anywhere.

**Source Guidelines**

Recognizing the challenges among illiterate populations for accessing and using digital solutions, UNESCO, in partnership with Pearson and Project Literacy, published *Guidelines for Designing Inclusive Digital Solutions and Developing Digital Skills* in 2018. These guidelines were created to help digital innovators build more inclusive technological solutions, providing factors to consider, questions to ask, and processes to follow when designing for low literacy users. The guidelines are as follows:

1. **Design with all the users, focusing on their needs and context**
2. **Focus on users’ digital skills and competences**
3. **Ensure the clarity and relevance of content for low-skilled and low-literate users**
4. **Use appropriate media and tailor user interfaces for low-skilled and low-literate users**
5. **Provide initial and ongoing training and support**
6. **Constantly monitor, measure, and improve**

We selected the four most relevant guidelines for developers and literacy practitioners using technology in low resource and connectivity settings. Literacy products, programs, and services designed for populations in low resourced and bandwidth setting must manage considerations beyond just inclusive digital design for literacy. With these guidelines and our actionable guidance, we aim to circumvent the barriers that leave people in low resourced and bandwidth settings frustrated and disinterested in literacy resources.

**Use appropriate media and tailor interfaces for low-skilled and low-literate users.**

Digital solutions depend on their users’ capabilities and technology contexts. Mixing media and input methods, like text, images, audio and video or typing and voice, provides options to adapt a solution for low-skilled and low-literate users. Think about how these different media and input methods will change depending on your target audience’s access to technology and connectivity.

- Which technology medium is most popular among your target audience? How can you design a literacy product to take advantage of that?
- Is the material organized in an intuitive and easy to use way?

💡 Use audio and visual demonstrations to explain how to use the product. Provide various resolution options to reduce the data load.
Consider the variety of platforms the content will be shared on: different operating systems, models, etc., and try to make the product as universal as possible.

Ensure access, regardless of power or connectivity
Prikkle is an Afrikaan word that means “to stimulate, inspire, and provoke.” At Prikkle Academy in Nigeria, young people are inspired to collaborate and learn together to solve local problems. The Center uses solar power and provides pre-downloaded educational resources on mobile phones and laptops to ensure access to education, regardless of power or internet availability.

Design with all users, focusing on their needs and context.
Understanding the context of your target audience is necessary to develop a solution that is relevant, usable, and beneficial. When working with a low resource and connectivity audience, the key considerations are what technology and connectivity users have access to and how they use it.

- What type of connectivity do expected end-users have? Can content be accessed offline?
- What are the electricity obstacles for the intended users? What alternatives can you use?
- What is the data size of your product? Will users need to update it?
- How reliant is your product on new content? How frequently will users need new content?
- How can you integrate a visual user guide?

Remember that multiple users may be using one device. Incorporate multiple-user profiles to allow for device sharing among family members or peers.

Involve the target audience in development and invite feedback at each major developmental stage.

Invite users to develop some of the literacy content to be used by their peers.

Minimize the data requirement.
After launching English Duniya, an English Learning mobile app, Zaya Learning Labs in India held feedback sessions with users to understand how to improve the program. One common challenge potential users reported was that they did not have enough storage on their device to download the app. In response, Zaya’s team trimmed down the packages used within the application, reducing the app’s size by 25 mb. After this improvement, they saw a much higher adoption rate of the app, bringing English learning to even more people.

Provide initial and ongoing training and support
Technology-based solutions can be challenging for any audience. In LRC settings, many are unlikely to have extensive digital skills. How can you provide support without relying on internet access or technological capabilities?

- What local support exists that could be leveraged to provide the first line of support? How can you leverage peer support?
• What options for support are available that are not reliant on internet access? Can you provide in-person trainings?

• What simple and low-cost outlets exist that could be used to provide ongoing support?

💡 Provide solutions to frequent challenges in an offline resource available with the product

💡 Use screencasts and videos to demonstrate exactly how to achieve a specific outcome on the platform

💡 Provide a local telephone number for users to call for support

💡 Send support via bulk SMS or messaging services

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**Be prepared to provide technical support unrelated to your product**

ReadaBookNigeria Initiative strives to connect literacy learners with the tools and resources to become passionate readers. When founder Uma Nnenna asked why an adult participant had stopped using a beneficial literacy app, she discovered it was “because the screen was too bright.” User support in the LRC setting often involves providing technical as well as program assistance, like showing a user how to change device brightness settings to comfortably use an app. Nnenna learned “we have to find a way around all of the hurdles that [learners] experience, even when we are not directly responsible for them.”

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**Constantly monitor, measure, and improve.**

Data collection is necessary to measure the impact of your product and make any improvements. The data you want is dependent on your product and goals. For low resource and connectivity users, consider methods of data collection and improvement updates appropriate to limited or no internet or electricity access.

• How will you collect user data? If data collection is automatic and embedded in the product, how can you minimize the data load?

• How often will users need or have internet connection to upload their data?

• How can you leverage existing mediums for data collection?

• How can you minimize the data load of improvement updates?

💡 Keep in mind that one tech-savvy user may be disseminating lessons and resources from your product to other, less tech-savvy users, so your user data may not be accurate. Periodic, in-person surveys may be more reliable.

💡 Consider non-internet-based data collection options. Local servers like Raspberry Pi can store data and pass it along to any connected laptops or mobile devices without internet.
Experiment with innovative technologies

Open Learning Exchange (OLE) Ghana provides rural schools with a product that serves as an exciting repository of literacy materials, learning management system, and data collector. However, most schools that they support are remote, with limited connectivity, making data collection challenging. The solution to this challenge was Raspberry Pi, a low-cost, low-power, general-purpose computer, which they program with resources for critical reading, teacher development, and literacy apps. The Raspberry Pi holds the usage data and facilitates its transfer by syncing onto third party devices such as tablets and laptops. These devices then upload the usage data so collected into cloud servers when they are connected to the internet, allowing OLE Ghana to share information with stakeholders, provide teacher support, and analyze pupil progress.

Conclusion

Literacy provides opportunity for our most vulnerable populations, who frequently are still excluded from educational resources due to poor connectivity or access to technology. With these considerations, we hope educational technology developers and program implementers will have the guidance to provide access to literacy resources among LRC communities. Together, we can unlock the potential of individuals, families, and communities, ensuring that by 2030, no child is born at risk of poor literacy.
ACCESSIBILITY

Introduction
Accessibility in technology refers to devices or digital platforms that can be independently used by people with a variety of disabilities. Within the literacy context, these disabilities are primarily those that impair (visual) reading, such as dyslexia, ADHD, autism, low vision, and binocular vision impairments.

Reading is a relatively recent human invention, so our brains have not evolved to make us all skilled readers. Instead, there is significant neurological diversity related to reading ability.

In decades and centuries past, this diversity of ability did not pose a critical problem because agrarian and industrial economies offer many opportunities to people regardless of reading ability. But in the information economy, readers who do not acquire strong reading skills face serious challenges in school and in the labor force.

Fortunately, we can use universal/inclusive design techniques to better serve neurodiverse and vision impaired populations so that they can read, learn and succeed.

Barriers and Challenges
One of the primary challenges to accessible design is that there has historically been a gap between the literacy community and the accessibility community, especially related to learning differences.

In the literacy community, accessibility concerns do not receive much attention, and in some cases accessibility features are even seen as something to be avoided.

- **Many popular literacy platforms lack even the most basic usability/accessibility options**, such as the ability to change text size or line spacing. These are critical for students with learning disabilities or visual challenges.
- **Developers favor the general education market.** Some literacy platforms purposely omit accessibility features because they don’t want to be perceived as an intervention tool. They believe that if they offer accessibility features, they will be pigeon-holed as an intervention and will have difficulty selling into the general education market.

In the accessibility community, the most-cited digital accessibility guidelines are the Web Content Accessibility Guidelines (WCAG). Unfortunately, WCAG does not focus on the types of high-incidence learning differences that are common among students and impair reading ability.

- The WCAG guidelines have focused on accessibility for people who are blind or nearly so, and have included practically no guidance that would be helpful to people with dyslexia, ADHD, or other learning differences
- The organization that promulgates the WCAG guidelines has put together a task force to add recommendations that will benefit these populations, but until these are finalized (likely next decade), the guidelines will be severely lacking with regard to helping neurodiverse populations.

Global Snapshot
- Dyslexia affects 15% to 20% of people and significantly affects reading ability ([Yale Center for Dyslexia and Creativity, 2017](https://dyslexia.yale.edu/dyslexia-creativity/))
- ADHD and other executive functioning challenges affect 10% of students and create difficulties for reading and comprehension ([Center for Disease Control, 2017](https://www.cdc.gov/mentalhealth/attention-deficit-hyperactivity-disorder/adhd-facts.htm))
- Vision problems—including those that cannot be detected by typical vision screening tests—impair students’ ability to read and learn, and are often misdiagnosed as dyslexia ([Optometrists’ Network](https://www.aao.org/consumer-information/eye-and-vision-conditions/learning-disabilities))
A Literacy Practitioner’s Guide to Education Technology Guidance

This brief summary shows how the accessibility community and literacy community are not well-aligned to help students with learning disabilities and vision impairments read, learn, and succeed.

Another challenge is the shift from computers to mobile devices, which makes accessibility an even more critical issue.

- On computers, a student can use accessibility-enhancing browser extensions, which can help make an inaccessible literacy platform more accessible.
- On mobile, there is no analog for these browser extensions. Apps generally are prohibited from communicating with one another, so there is no way for a student or teacher to make an inaccessible platform more accessible by using plugins or extensions.
- As a result, it is critical that literacy platforms—and learning platforms in general—be designed in a way that is accessible for all students.

**Improving Literacy and Accessibility**
There are two key ways to improve literacy outcomes for learners who have special needs.

1. Enhance digital literacy platforms with proven UI features that can improve reading performance for a wide range of students
2. Change the language around accessibility in educational platforms so that it focuses more on inclusivity and personalization instead of dividing students into general ed and special ed.

**Accessibility Features for Digital Literacy Platforms**
The Center for Applied Special Technology (CAST), which developed the concept of Universal Design for Learning, recently launched the CISL Project (Center on Inclusive Software for Learning), which aims to identify the most important universal design features for the textual aspects of digital textbooks. In their [CISL demo page](#), they highlight several features:

- The ability to increase text size, kerning (space between letters), and line spacing
- The ability to select between sans serif, serif, and specialized fonts (Comic Sans and Open Dyslexic)
- The ability to choose between various background colors such as black or tan
- The ability to enable line-wrapping color gradients, developed by BeeLine Reader[^20], which aid visual tracking
- The ability to click key words and instantly access a dictionary definition

**Bookshare**, which has built the world’s largest accessible ebook library and is funded by grants from the Office of Special Education Programs (part of the federal Department of Education), has substantial feature overlap with the CISL Project demo, and also adds in a few additional features such as margin width and text-to-speech.

<table>
<thead>
<tr>
<th>Feature</th>
<th>CAST’s Project CISL</th>
<th>Text Size</th>
<th>Text Kerning</th>
<th>Line Spacing</th>
<th>Multiple Fonts</th>
<th>Multiple Background Colors</th>
<th>BeeLine Color Gradient</th>
<th>Word Definitions</th>
<th>Margin Width</th>
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<tbody>
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<td><strong>BeeLine Color Gradient</strong></td>
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[^20]: BeeLine Reader is an online reading extension that uses an eye-guiding color gradient to pull your eyes from one line to text to the next.
Offering these features would greatly enhance the accessibility of a literacy platform for the millions of students who have dyslexia, ADHD, or vision challenges. And because of the nature of UDL enhancements, these features can also benefit skilled readers who appreciate the ability to customize the reading experience. For example, many of these features are offered in popular ebook platforms (the Nook ereader offers most of these options).

**Changing the Language Around Accessibility and Literacy**

One way to facilitate the adoption of features like these in literacy platforms is to change the language around accessibility in literacy. Instead of using language that draws attention to differences between students, such as “special needs” or even “assistive technology,” it would be helpful to focus on terms that are more universal, or which are aligned with popular educational trends.

- Instead of “accessibility features,” refer to these features as “inclusive design,” “universal design for learning,” or simply “usability” in the context of product design.
- Refer to assistive technologies as “personalized learning” techniques

These suggested terms evoke popular pedagogical trends, which education professionals are familiar with and believe in. Using these terms also illustrates that accessibility is about inclusivity/universality—and who would be opposed to that?

Similarly, framing assistive technology as one aspect of personalized learning shows that if we have decided that it is important to personalize the content that students learn, it would be silly not to also personalize the mode of delivery. These linguistic changes are in no way meant to deceive— all of the suggested terms are accurate descriptors of what assistive technology features are. These changes are instead intended to change the framing of the issue so that people realize that accessibility truly is a critical part of any literacy platform.

**Bright Spots**

One bit of good news is that the ePub 3 ebook format supports several of the above features, and because it supports JavaScript, it can be extended to support all of them. At this time, ePub-based learning platforms are much more common in the higher education space. Hopefully, they will also be adopted by K-12 learning platforms, where students with reading challenges need them the most. Parents and literacy professionals can also use [Understood.org](http://Understood.org), a resource portal from Learning Disabilities Association of America to help identify technology, tools, and practices to support children with learning disabilities.

**Conclusion**

The path forward has two steps. First, we should follow the lead of organizations like CAST and Bookshare, whose work highlights some of the most effective tools for increasing the accessibility of text. Fortunately, these features are relatively straightforward to implement from a technical perspective, so even smaller literacy platforms or edtech startups should be able to put these into practice.

Second, we should work to change the language around accessibility and literacy. By framing the conversation around “inclusive design” and “personalized learning,” we can emphasize the similarities between accessibility/assistive technology and highly-regarded educational and design methodologies.
AMPLIFYING THE ROLE OF TECHNOLOGY TO REACH UNDERSERVED POPULATIONS

Technology provides the opportunity for new and innovative literacy initiatives to impact the lives of millions around the world. These three guidance documents have expanded existing recommendations with practical expertise to help design digital solutions for underserved populations.

We hope that the actionable guidance provided here will help literacy practitioners reach these populations with effective literacy tools. Adult learners, those in low resource and connectivity settings, and neurodiverse and vision-impaired populations can use technology to improve their literacy. Together, we can make significant and sustainable advances in literacy, ensuring that no child will be born at risk of illiteracy by 2030.

We hope that you will use this practical advice to expand the potential for technology to increase literacy worldwide. If you have any questions or feedback, please contact Kavita Hatipoglu (khatipoglu@r4d.org). This guide was made possible by the collaboration literacy experts sharing their knowledge and will continue to enrich the literacy field through more sharing and collaboration.

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