ALL CHILDREN READING:
GRAND CHALLENGE FOR DEVELOPMENT

EVALUATION REPORT

Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing

Implemented by the Institute for Disabilities Research and Training & École Nationale Supérieure des Mines de Rabat in Morocco

JULY 2018

Prepared by
School-to-School International (STS)
For All Children Reading: A Grand Challenge for Development

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List of Acronyms

ACR GCD	All Children Reading: A Grand Challenge for Development
ASL	American Sign Language
CFWP2M	Correct Familiar Words Signed per Two Minutes
CLNP2M	Correct Letter Names Signed per Two Minutes
CRPD	Commission for the Right of Persons with Disability
CWP2M	Correct Words Signed per Two Minutes
EGRA	Early Grade Reading Assessment
EGRSLA	Early Grade Reading and Sign Language Assessment
ENSMR	École Nationale Supérieure des Mines de Rabat
EOP	End-of-Project
IDRT	Institute for Disabilities Research and Training
IRB	Institutional Review Board
IRR	Interrater Reliability
MDSFS	Ministry of Solidarity, Women, Family, and Social Development
MNE	Ministry of National Education, Vocational Training, Higher Education, and Scientific Research
MSA	Modern Standard Arabic
MSL	Moroccan Sign Language
NGO	Nongovernmental Organization
PEER	Partnerships for Enhanced Engagement in Research
RTI	RTI International
SD	Standard Deviation
SSME	Snapshot of School Management and Effectiveness
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
USAID	United States Agency for International Development
WFD	World Federation of the Deaf

I. Executive Summary

All Children Reading: A Grand Challenge for Development (ACR GCD)—a partnership between the United States Agency for International Development (USAID), World Vision, and the Australian Government—is an ongoing series of grant and prize competitions that leverage science and technology to source, test, and disseminate scalable solutions to improve literacy skills of early grade learners in developing countries. Round 2 of ACR GCD, which started in 2014 and continues through 2018, supports technology-based innovations to improve early grade reading outcomes in developing countries.[1]

The Institute for Disabilities Research and Training (IDRT)—an ACR GCD Round 2 grantee—implemented the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project in collaboration with the École Nationale Supérieure des Mines de Rabat (ENSMR), their local partner. The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project began in October 2015 and ends in October 2018. It aimed to improve the reading skills of students who are deaf or hard of hearing in Morocco by providing teachers with an assistive technology: Moroccan Sign Language (*MSL*) *Clip and Create* software. The software contains a dictionary of MSL depicted in graphics, video clips, and supporting concept graphics. It allows teachers to create, publish, and print customized materials that provide MSL-translations of written text and to generate instructional activities incorporating both MSL and Modern Standard Arabic (MSA). IDRT also delivered trainings to teachers,[2] school directors,[3] parents,[4] and key stakeholders of Deaf associations in Morocco, as well as supported the creation of a steering committee to engage decision makers to discuss the needs in Deaf education.

In collaboration with IDRT, School-to-School International (STS) developed and administered an early grade reading and sign language assessment (EGRSLA)—an adapted version of the Early Grade Reading Assessment (EGRA)—to assess the MSA and MSL skills of students who are deaf or hard of hearing in Morocco. Using a reflexive-comparison research design, STS conducted two assessments: a baseline in December 2017 and January 2018, and an endline in May 2018.[5] Results from the assessments served to answer the project's key research question, *How did the MSA reading skills and MSL comprehension of students whose teachers had access to the MSL Clip and Create software change over the course of an academic year?*

STS also conducted additional qualitative research to respond to three supplemental research questions common to all ACR GCD grantees:

1. How successful was the rollout of the project?
2. How did the project influence or impact adults'—teachers, parents, community members—knowledge, skills, or attitudes regarding children's ability to learn to read and sign?
3. How did the project influence certain subsets of the student population more than others, based on identifiable contextual factors?

1 All Children Reading: A Grand Challenge for Development, "About Us," accessed July 2018, https://allchildrenreading.org/about-us/.

2 For the purposes of this report, "teacher" refers to the lead classroom educator in the private education centers run by nongovernmental Deaf associations and in the public general education school with an integrated classroom.

3 For the purposes of this report, "school director" refers to the designated director of the private education centers run by nongovernmental Deaf associations and of the public general education school with an integrated classroom. Some school directors also serve as Deaf association member presidents or steering committee members.

4 The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project intends to provide direct training and support to parents before the end of the grant, although none of these supports had been delivered by publication of this report.

5 A reflexive-comparison design compares results of the same group before and after an intervention. This research design does not include a control or comparison group.

The following project evaluation report answers these research questions by presenting an overview of the current policies and practices guiding early grade education for students who are deaf or hard of hearing in Morocco, a description of IDRT's project, quantitative and qualitative findings, and lessons learned.

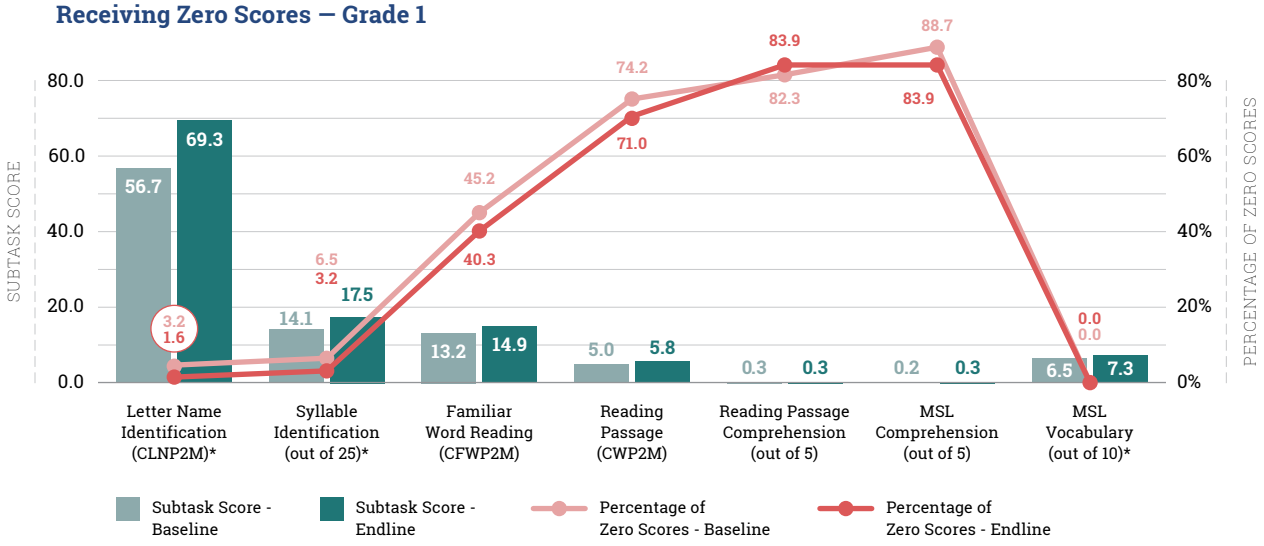
Notable EGRSLA findings from the 133 students assessed are presented below.

Key EGRSLA Findings[6]

Grade 1

- **Grade 1 students had statistically higher scores on the endline than on the baseline on the letter name identification and syllable identification subtasks.** Specifically, letter name identification fluency increased from an average of 56.7 to 69.3 correct letter names signed per two minutes. On the syllable identification subtask, grade 1 students correctly signed, on average, 14.1 syllables out of 25 at baseline, compared with 17.5 at endline. There was no statistical difference between the mean scores at baseline and endline on the familiar word reading, reading passage, reading passage comprehension, and MSL comprehension subtasks.
- **A statistically significant difference was observed between baseline and endline for grade 1 students on the MSL vocabulary assessment.** At baseline, grade 1 students were able to watch a video of a sign and correctly identify the corresponding clip art images for 6.5 video-clip art pairs, on average. At endline, grade 1 students correctly matched 7.3 clip art images to their sign, on average.
- **At endline, a majority of grade 1 students were unable to answer a single reading passage comprehension or a MSL comprehension question correctly; they were also unable to sign a single correct word on the reading passage subtask.** On the reading passage comprehension subtask, 83.9 percent of students received zero scores at endline, and on the MSL comprehension subtask, 83.9 percent of students received zero scores.[7] On the reading passage subtask, 71.0 percent of students received zero scores at endline.
- **There were no statistically significant differences between the proportion of grade 1 students receiving zero scores at baseline and endline on any subtask.**

Figure 1: **Summary of EGRSLA and MSL Vocabulary Mean Scores and the Percentage of Students Receiving Zero Scores — Grade 1**



Note: Grade 1 *n* = 62. An asterisk (*) indicates that the average scores for the baseline and endline EGRSLA were statistically significantly different at p<0.05.

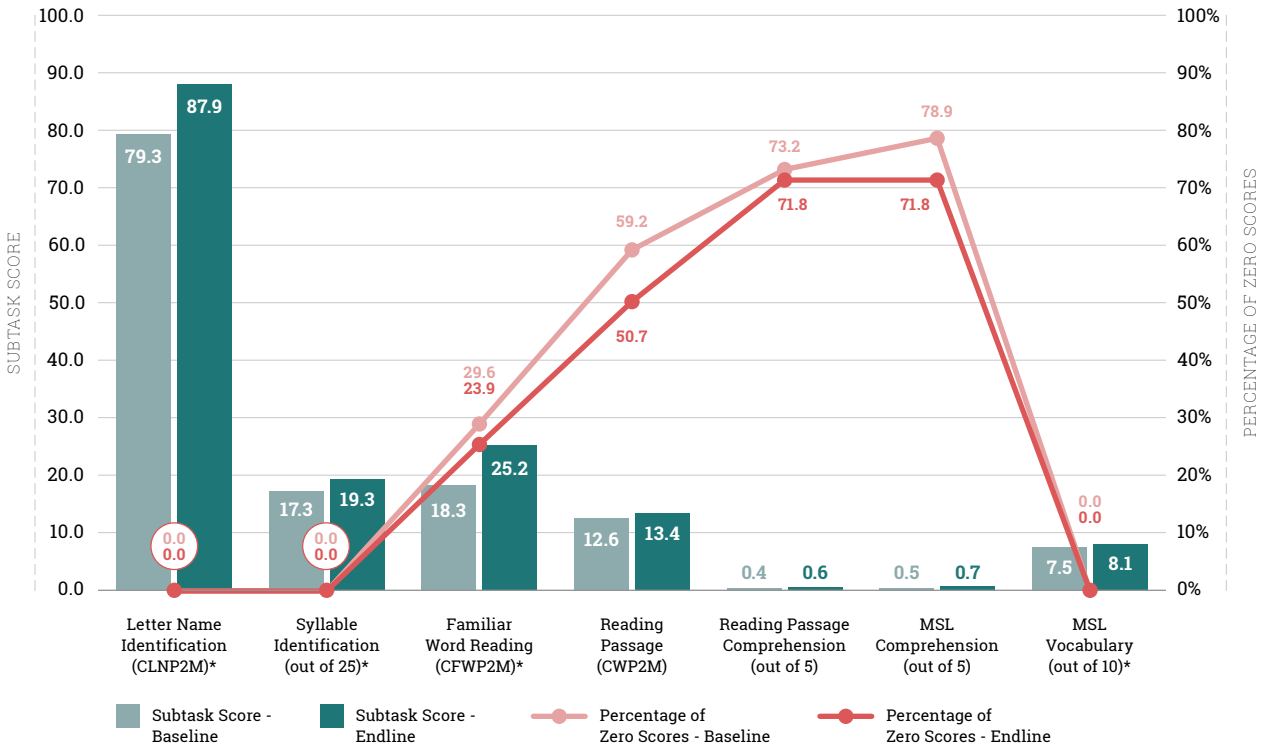
6 Because of the lack of a control or comparison group, EGRSLA results conflate gains associated with the project and those from an additional five months of schooling.

7 Students receive a zero score if they are unable to correctly identify a single item on a subtask. In this report, zero scores are shown as the number of students or as the total percentage of students unable to correctly identify a single item on a subtask.

Grade 2

- **Grade 2 students had statistically higher scores at endline than at baseline on the letter name identification, syllable identification, and familiar word reading subtasks.** On the familiar word reading subtask, grade 2 students correctly signed an average of 18.3 familiar words in two minutes at baseline, compared with 25.2 words at endline. There was no statistical difference in grade 2 students' performance between baseline and endline on the reading passage, reading passage comprehension, or MSL comprehension subtasks.
- **There was a statistically significant difference between baseline and endline scores on the MSL vocabulary assessment for Grade 2 students.** Specifically, students correctly matched 7.5 clip art images to their corresponding sign at baseline compared to 8.1 at endline, on average.
- **At endline, a majority of grade 2 students were unable to answer a single reading passage comprehension or a MSL comprehension question correctly; they were also unable to sign a single word correctly on the reading passage subtask.** On both the reading passage comprehension and MSL comprehension subtasks, 71.8 percent of students received zero scores at endline. On the reading passage subtask, 50.7 percent of students received zero scores at endline.
- **There were no statistically significant differences between the proportion of grade 2 students receiving zero scores at baseline and endline on any subtask.**

Figure 2: **Summary of EGRSLA and MSL Vocabulary Mean Scores and the Percentage of Students Receiving Zero Scores — Grade 2**



Note: Grade 2 *n* = 71. An asterisk (*) indicates that the average scores for the baseline and endline EGRSLA were statistically significantly different at p<0.05.

Gender[8]

- **The only statistically significant difference in EGRSLA scores between boys and girls at endline was observed on the reading passage subtask for grade 1 students.** Specifically, grade 1 girls could read and sign 12.5 correct words in two minutes, while grade 1 boys could read and sign 2.8 correct words in two minutes.
- **A statistically significantly higher proportion of grade 1 boys received zero scores than did grade 1 girls on the reading passage and reading passage comprehension subtasks at endline.** On the reading passage subtask, 79.1 percent of boys were unable to correctly sign a single word at endline compared with 52.6 percent of girls. On the reading passage comprehension subtask, 90.7 percent of boys received zero scores compared with 68.4 percent of girls. There was no statistically significant difference between the proportion of grade 2 boys and girls receiving zero scores at endline.

Other Findings

- **There was notable variation in students' performance on the EGRSLA across the eight research schools at endline.** On the letter name identification subtask, average fluency rates by school ranged from 26.3 to 99.3 correctly signed letter names in two minutes for grade 1 students and 56.2 to 121.9 correctly signed letter names in two minutes for grade 2 students. Similarly, on the familiar word reading subtask, grade 1 students in the lowest performing school signed an average of 0.0 correct familiar words in two minutes compared with 38.1 in the highest performing school. For grade 2, fluency rates ranged from 3.6 to 54.1 correctly signed familiar words in two minutes.
- **Reported usage of the software varied across the eight research schools over a six-month period.** The two schools with the highest reported average usage utilized *MSL Clip and Create* more than four times as often as the two schools with the lowest reported average usage.
- **At endline, many teachers appeared to value the use of MSL over oral language in their teaching.** When asked if they believed that they should teach using MSL instead of using oral language, ten out of 13 teachers agreed or strongly agreed, while three disagreed.

Summary, Conclusions, and Lessons Learned

Overall, results from the EGRSLA and MSL vocabulary assessment indicate that students' skills are improving over time. However, these improvements are uneven across schools. Moreover, results on the reading passage, reading passage comprehension, and MSL comprehension subtasks point to fundamental challenges among early grade students in full sentence reading and comprehension in both MSA and MSL. Despite the positive impressions of many stakeholders about the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project, quantitative and qualitative findings indicate that the project design did not adequately address the most immediate literacy and MSL needs of students, or the instructional needs of their teachers.

There are, however, fundamental systemic issues confronting students who are deaf or hard of hearing and their educators. Although these challenges were outside the scope of the project, they constrained the project's ability to influence students' reading and MSL skills development.

8 Sample sizes by gender: Grade 1 girls $n = 19$, boys $n = 43$; Grade 2 girls $n = 30$, boys $n = 41$.

Even with international and domestic policy frameworks in Morocco mandating the equal treatment of people with disabilities, full implementation has yet to be realized. Most students who are deaf or hard of hearing in Morocco are educated in segregated education centers that are privately managed with no governmental oversight, resulting in unequal educational experiences. Furthermore, teachers at these education centers are not sufficiently trained in special education nor are they fluent in MSL, both of which exacerbate the educational challenges faced by students. There are limited options for students who are deaf or hard of hearing to attend preschool or secondary school, and access to vocational training is uneven. Even for those children who do learn MSL, the public's lack of capacity to communicate with individuals who are deaf or hard of hearing, and the dearth of MSL interpreters to address this gap in communication, limit opportunities for integration and inclusion into Moroccan society.

Given the complex and comprehensive challenges surrounding Deaf education and the lack of equal rights for people who are deaf or hard of hearing in Morocco, it is improbable that a small-scale, technology-focused intervention will have the ability to make sustainable and broad-based impact on the system-wide challenges affecting the reading abilities of students who are deaf or hard of hearing.

Regardless, there are several critical lessons learned through the implementation of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project that can inform donors interested in funding projects for students who are deaf or hard of hearing, as well as other stakeholders interested in improving Deaf education in Morocco more broadly.

- Projects supporting children who are deaf or hard of hearing should include components of parental engagement, especially in contexts where deafness is poorly understood, and sign language is underutilized.
- Projects that work to support people with disabilities should, as much as possible, engage experts with disabilities to design, lead, and participate in the work.
- Assistive technologies have the potential to provide support to teachers, especially in contexts where there is little access to teaching resources.
- Systematic and cross-sectoral needs assessments should be conducted prior to a project's implementation to determine training and technological priorities of the beneficiary population.
- Projects focused on supporting under- or undocumented languages should ensure inclusion of all relevant stakeholders and language users in the documentation process, especially when supporting marginalized or disenfranchised populations.
- Coordination and communication across key stakeholders should be prioritized to create sustainable and targeted interventions that support beneficiaries.

II. Introduction

All Children Reading: A Grand Challenge for Development (ACR GCD)—a partnership between the United States Agency for International Development (USAID), World Vision, and the Australian Government—is an ongoing series of grant and prize competitions that leverage science and technology to source, test, and disseminate scalable solutions to improve literacy skills of early grade learners in developing countries. Round 2 of ACR GCD, which started in 2014 and continues through 2018, supports technology-based innovations to improve early grade reading outcomes in developing countries.[9] These technology-based innovations concentrate on three focus areas:

1. Mother tongue instruction and reading materials
2. Family and community engagement
3. Children with disabilities

ACR GCD Round 2 increased its focus on the assessment of early grade reading skills to understand the ability of technology-based innovations to improve the literacy skills of early grade learners. To measure this, ACR GCD uses the Early Grade Reading Assessment (EGRA) to systematically assess reading skills across all Round 2 grantees. The EGRA is an oral assessment that measures students' most basic foundational literacy skills in the early grades—specifically, recognizing letters of the alphabet, reading simple words, understanding sentences and paragraphs, and listening with comprehension. The EGRA methodology was developed under EdData II and has been applied in more than 30 countries and 60 languages.[10] The EGRA instruments used by ACR GCD grantees were adapted to reflect the specific context of each grantee's project, including adaptations for students who have low vision or are blind and students who are deaf or hard of hearing.

The Institute for Disabilities Research and Training (IDRT)—an ACR GCD Round 2 grantee—implemented the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project in collaboration with the École Nationale Supérieure des Mines de Rabat (ENSMR), their local partner. The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project began in October 2015 and ends in October 2018. It aims to improve the reading skills of students who are deaf or hard of hearing in Morocco by providing teachers with an assistive technology—Moroccan Sign Language (*MSL*) *Clip and Create* software. The software (Version 2.0) contains a dictionary of nearly 3,000 MSL signs that are depicted as images and in video. It also includes the corresponding Arabic word, supporting concept pictures, and definitions in Arabic (text) and MSL (video). It allows teachers to create, publish, and print customized materials and to generate customized instructional activities that incorporate both MSL and MSA. Six stories with MSL-translations of written text, three of which are from the national grade 1 and 2 textbooks, were included in the software. IDRT also delivered trainings to teachers, school directors, parents, and key stakeholders of Deaf associations in Morocco, as well as supported the creation of a steering committee to engage decision makers to discuss the needs in Deaf education.

To understand how the project impacted participating students' reading skills, School-to-School International (STS) developed an early grade reading and sign language assessment (EGRSLA)—an adapted version of the EGRA—to assess the MSA and MSL skills of students who are deaf or hard of hearing in Morocco. Using a reflexive-comparison research design, STS and IDRT piloted the EGRSLA in October and November 2016, collected baseline data in December 2017 and January 2018, and collected endline data in May 2018. Prior to

9 All Children Reading: A Grand Challenge for Development, "About Us," accessed July 2018, https://allchildrenreading.org/about-us/.

10 EdData II was a contract mechanism funded by USAID from January 1, 2004, to December 31, 2013. Implemented by RTI International, the purpose of EdData II was to improve the accuracy, timeliness, accessibility, and use of data for education policy and program planning. See http://www.rti.org/sites/default/files/brochures/eddataii.pdf for additional details.

the endline data collection, STS conducted qualitative end-of-project (EOP) interviews with the Ministry of National Education, Vocational Training, Higher Education, and Scientific Research (MNE), steering committee members, USAID staff, project staff, school directors, teachers, and parents. The interviews sought to determine any lessons learned from project implementation, better understand how the project impacted students and teachers, and assess the sustainability and scalability of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project.

The following project evaluation report presents an overview of the current policies and practices guiding early grade education for students who are deaf or hard of hearing in Morocco, a description of IDRT's project, quantitative and qualitative findings, and lessons learned.

III. Context

An understanding of the current state of Deaf education in Morocco is critical to contextualize the EGRSLA and qualitative findings presented in this report. According to the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), children who are deaf have the same right to quality education as other children. This includes having access to sign language and visual strategies to ensure that they can access quality education. Nevertheless, students who are deaf or hard of hearing in Morocco do not have universal or equal access to quality education, a factor that results from several contextual characteristics of the education sector. Many of the limitations facing students who are deaf or hard of hearing were outside of the scope of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard project but may have impacted the project's implementation and effectiveness.

This section draws heavily on RTI International's (RTI) 2016 report, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco*, which was commissioned by the Ministry of National Education and Vocational Training[11] in partnership with USAID.

Policy Context

There is substantial policy and legislative support for students with disabilities in Morocco. The preamble of the Constitution of Morocco states that the Kingdom is committed to fighting "all forms of discrimination based on… disability or any personal status."[12] Article 34 of the Constitution predicates that the government should rehabilitate and integrate persons who have physical, sensorimotor, or mental handicaps and "facilitate their enjoyment of the rights and freedoms recognized to all."[13] Although the 1963 Compulsory Basic Education Act requires that education is compulsory for all children without specifically referencing children with disabilities, a ministerial memorandum in 2015 gave all children with mild or moderate disabilities the right to enroll in integrated or regular classes in public schools.[14, 15]

Morocco signed the UNCRPD in March 2007 and further ratified it in April 2009.[16] The UNCRPD established overall guiding principles for the treatment of people with disabilities and outlines specific rights, including access to justice and health, as well as respect of home and family.[17] Article 24 specifically addresses education for persons with disabilities. It declares that signatories should ensure an inclusive education system so that students with disabilities are not excluded on the basis of their disability, have a right to quality and free primary education, and have reasonable accommodations to meet their academic and social development needs.[18] Article 24 further states that signatories should facilitate "the learning of sign language and the promotion of the linguistic identity of the deaf community;" and ensure that

> "the education of persons, and in particular children, who are blind, deaf, or deafblind, is delivered in the most appropriate languages and modes and means of communication for the individual, and in environments which maximize academic and social development."[19]

11 Since the publication of the *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* report, the Ministry of National Education and Vocational Training has changed to the Ministry of National Education, Vocational Training, Higher Education, and Scientific Research.

12 Constitution of the Kingdom of Morocco, preamble.

13 Constitution of the Kingdom of Morocco, title 2 § art. 34.

14 Kingdom of Morocco, Dahir No. 1-63-071 of 25 Jumada II 1382.

15 Kingdom of Morocco, Ministerial Memorandum No. 98/104 on the integration of children with disabilities in public schools.

16 Office of the United Nations High Commissioner for Human Rights, "Status of Ratification Interactive Dashboard," accessed July 2018, http://indicators.ohchr.org/.

17 United Nations, "Convention on the Rights of Persons with Disabilities (CRPD)," accessed July 2018, https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html.

18 United Nations Convention on the Rights of Persons with Disabilities, art. 24.

19 United Nations Convention on the Rights of Persons with Disabilities, art. 24.

Finally, to support the inclusion of students with disabilities, Article 24 dictates that signatories should "employ teachers, including teachers with disabilities, who are qualified in sign language … and to train professionals and staff who work at all levels of education."[20] The article specifies that the training should include disability awareness and use of different forms of communication, educational techniques, and materials to support these students.[21]

In 2016, Morocco adopted a new disability law to better align domestic policy with the international standards outlined in the UNCRPD. Specifically, this law articulates in Article 11 that, "persons with disabilities have the right to education, instruction, and training in all cycles, including the right to freely choose the appropriate options they wish to take in pursuing their studies."[22] Article 13 calls for the establishment of regional commissions that will examine the records of school-age children with disabilities to monitor their curriculum and course of training.[23]

Despite the international and domestic policy frameworks mandating the equal treatment of people with disabilities, full implementation has yet to be realized. In a survey conducted by RTI, 86 percent of parents of children who are deaf said, "current laws do not address the needs or ensure that children with disabilities can access a quality education" and that the educational context in Morocco does not reflect the standards outlined in the UNCRPD or the disability law.[24]

Educational Context

To understand the challenges facing these students, their educators, and stakeholders, several key characteristics of the education system for students who are deaf or hard of hearing are detailed in this section. These factors—school attendance, access to secondary and higher education, access to inclusive classrooms, and lack of teachers and interpreters who are fluent in MSL—help provide a greater understanding of the problems that the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project sought to address.

School Attendance and Progression

Despite variation across different data sources, school enrollment for students with disabilities in Morocco is unarguably low. The Ministry of Solidarity, Women, Family, and Social Development (MDSFS), using the 2014 national census, estimated that there were 1,540,000 persons with disabilities in Morocco.[25] The 2004 national census also indicated that 73 percent of children with disabilities never attended school.[26] In a 2014 survey conducted by MDSFS, 60 percent of children with disabilities reported they did not attend school because the schools were inappropriate for them.[27] The Commission for the Right of Persons with Disability (CRPD) country

20 United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), Article 24, "Education," December 13, 2006, https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/article-24-education.html.

21 United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), Article 24, "Education," December 13, 2006, https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/article-24-education.html.

22 Kingdom of Morocco, Law No. 5-81 on the welfare of the blind and visually impaired.

23 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

24 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

25 United Nations Educational, Scientific and Cultural Organization, *Education for All 2013-2015 National Review Report: Morocco*, (New York: United Nations, 2014), accessed July 2018, http://unesdoc.unesco.org/images/0023/002317/231799e.pdf.

26 Zineb El Ouazzani Touahami, "Moroccan Experience on Disability Statistics," Presented at the Washington Group Meeting in Copenhagen, Denmark, October 27–29, 2015, https://www.cdc.gov/nchs/data/washington_group/meeting15/wg15_session_8_4_touhami.pdf.

27 Ministry of Solidarity, Women, Family and Social Development, "Results of National Disability Survey, Detailed Report," (February 2015).

report for Morocco cites that 53.3 percent of children with disabilities who are between the ages of 10 and 14 have never attended school; education stakeholders reported to RTI that they believe 5 to 10 percent of children with disabilities attend school.[28]

For those children with disabilities who do attend school, most have been and continue to be educated in segregated education centers that are managed by private associations or nonprofit organizations.[29, 30] These centers have different sources and unequal levels of funding; some receive support from the government, while others rely on outside donor funds or direct tuition fees—or a combination of both. In some cases, education centers charge monthly tuition as high as 2,500 Moroccan dirhams ($250).[31] Because these education centers are not overseen by MNE, they do not necessarily conform to national education standards that other public schools are obliged to meet, such as curriculum and teacher qualification. Further, these centers are rarely able to offer any educational opportunities beyond primary school, and many students do not complete primary schooling through grade 6. In 2014, the UNESCO *Education for All 2013-2015 National Review Report* on Morocco estimated that less than 12 percent of students with disabilities completed primary school.[32]

Access to Inclusive Education

Inclusive education is defined as an environment where all students are learning together in the same classroom, using the same materials appropriate to their needs, and participating in the same lessons and recreation.[33] Access to inclusive education is encompassed in a human rights-based approach to education that ensures that students with disabilities have the ability to develop both academically and socially to reach full inclusion in society.[34]

Based on the 2016 Morocco disability law, students with disabilities should have equal access to whichever educational option they want to pursue. In 2015, MNE reported having an estimated 555 "integrated classes" within 383 schools, which serve 5,998 boys and 2,226 girls with disabilities throughout Morocco.[35, 36] In the Moroccan context, an integrated classroom is one in which "children with disabilities attend a general education school but receive instruction in specialized or segregated classrooms apart from other students."[37] These

28 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

29 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

30 The exact number of education centers for students who are deaf or hard of hearing was unavailable; however, statistics indicate that there were 48 specialized centers for students with disabilities in 2014, with a combined enrollment of 4,652 students.

31 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

32 United Nations Educational, Scientific and Cultural Organization, *Education for All 2013-2015 National Review Report: Morocco*, (New York: United Nations, 2014), accessed July 2018, http://unesdoc.unesco.org/images/0023/002317/231799e.pdf.

33 Leonard Cheshire Disability, *Inclusive Education: An Introduction*, (London: Leonard Cheshire Disability), https://www.leonardcheshire.org/sites/default/files/LCD_InclusiveEd_012713interactive.pdf.

34 The human rights-based model is closely aligned with the UNCRPD. This model focuses on the fulfilment of rights such as equal opportunities and participation for people with disabilities and also puts the onus of response on society rather than the individual. See Humanity & Inclusion and CMB International. "Making PRSP Inclusive: The Four Models." Accessed July 2018. http://www.making-prsp-inclusive.org/en/6-disability/61-what-is-disability/611-the-four-models.html and Jackson, Mary Ann. "Models of Disability and Human Rights: Informing the Improvement of Built Environment Accessibility for People with Disability at Neighborhood Scale?" *Laws* 7, no. 1 (2018), doi: http://www.mdpi.com/2075-471X/7/1/10.

35 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

36 It is not clear how many classrooms are specifically dedicated to students who are deaf or hard of hearing, although an MNE representative interviewed stated there are 55 teachers trained to teach integrated classes for students who are deaf or hard of hearing in government general education schools.

37 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

integrated classrooms tended to be congregated in urban areas, such as Rabat, Marrakesh, and Casablanca; for the government to establish an integrated classroom, there must be at least five students with the same disability willing to enroll.[38] Students who are enrolled in an integrated classroom may transition into a mainstream grade 1 class after three years, and presently, only children with "light" or "mild" disabilities are eligible to be considered for integration into general education schools.[39, 40] To participate in an integrated class or to be mainstreamed into general education grade 1 classrooms, any student with a disability must be approved by an inclusion committee comprised of the school director, inspector of inclusive education, coordinator for inclusive education, and teacher for inclusive education. Students who are not approved are sent home or to segregated schools.[41]

These strict guidelines for establishing and enrolling in integrated classrooms pose significant challenges for students who are deaf or hard of hearing. As a result, many students are educated in segregated education centers run by private associations or nonprofit institutions instead of in government-run general education schools. A parent survey conducted by RTI asked parents what type of school their child who is deaf or hard of hearing attended; 67 percent of parents reported that their child attended a private school for the deaf, 19 percent reported that their child attended a government-run school for the deaf, and 4 percent said they attended a public general education school. The remaining 11 percent of parents had children who attended a private or nongovernmental organization (NGO) general education school.

There is concern over the privatization of Deaf education and the segregation of students who are deaf or hard of hearing. Human Rights Watch sent a letter to the Moroccan Parliament in 2015 regarding the draft 2016 disability law. The letter expressed concerns that the law did not take a human rights-based approach and instead mandated separate classes or schools for children with disabilities rather than focusing on inclusive education. The letter also called attention to the fact that special education was predominately provided by private or nonprofit organizations with limited government support or oversight.[42]

Access to Bilingual Education and Trained Teachers

The CRPD and the World Federation of the Deaf (WFD) advocate that students who are deaf should be educated using a bilingual approach, meaning that instruction should utilize students' native sign language and the written language of instruction.[43, 44] Specifically, the WFD states that children who are deaf should have access to a schooling environment where they can be fully immersed in sign language and yet still follow the national curriculum.[45] Research has shown that the use of sign language for children who are deaf or hard of hearing can

38 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

39 MDSFS determines the level of disability using a screener questionnaire. See http://www.social.gov.ma/sites/default/files/ENPH%20Rapport%20Fr%20BAT%20OL%20.pdf.

40 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

41 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

42 Human Rights Watch, "Letter to Moroccan Parliament on Draft Disability Law," accessed July 2018, https://www.hrw.org/news/2015/10/26/letter-moroccan-parliament-draft-disability-law.

43 United Nations Convention on the Rights of Persons with Disabilities, art. 24.

44 World Federation of the Deaf, "WFD Position Paper on the Language Rights of Deaf Children," accessed July 2018, https://2tdzpf2t7hxmggqhq3njno1y-wpengine.netdna-ssl.com/wp-content/uploads/2017/01/WFD-Position-Paper-on-Language-Rights-of-Deaf-Children-7-Sept-2016.pdf.

45 World Federation of the Deaf, "WFD Position Paper on the Language Rights of Deaf Children," accessed July 2018, https://2tdzpf2t7hxmggqhq3njno1y-wpengine.netdna-ssl.com/wp-content/uploads/2017/01/WFD-Position-Paper-on-Language-Rights-of-Deaf-Children-7-Sept-2016.pdf.

promote "linguistic, communication, cognitive, academic, and literacy development as well as social-emotional growth and identify formation."[46] Even for children with some exposure to spoken language through a hearing aid or cochlear implant, language delays can occur if an accessible language is not used as early as possible.[47]

The current education system in Morocco does not provide comprehensive bilingual education to students who are deaf or hard of hearing. Most Deaf education teachers in Morocco have no formal teacher training and have limited fluency in MSL. There is no degree in special education, blind education, or Deaf education in Morocco; in-service teacher training opportunities are limited.[48] Although teachers hired by private associations that run schools for the Deaf have received specialized training through their educational institution, there is a dearth of qualified teachers in these classrooms.[49, 50] Further, there is no formal or standard oversight of these schools, and as a result, each association school has a unique approach to recruiting, training, and managing their teaching staff—including classroom aides—and on use of MSL and oral and written MSA.[51]

In the absence of teachers fluent in MSL, certified sign language interpreters can support bilingual education for students who are deaf or hard of hearing. It is important that sign language interpreters within schools be trained and certified in sign language interpretation and be fluent in the local sign language to sustain cultural identities and the heritage of students.[52, 53] According to the Morocco Association of the Deaf, there is no formal training or certification process for MSL interpreters, and there are very few sign language interpreters in the country.[54]

IDRT worked with nine private education centers operated by nongovernmental Deaf associations specifically for students who are deaf or hard of hearing and with one public general education school with an integrated classroom. All of these are impacted by the constraints outlined in this section.

46 Debra Berlin Nussbaum, Susanne Scott and Laurene E. Simms, "The 'Why' and 'How' of an ASL/English Bimodal Bilingual Program," accessed July 2018, http://www3.gallaudet.edu/Images/Clerc/articles/Odyssey_SPR_2012_NussbaumScottSimms.pdf (2012).

47 Debra Berlin Nussbaum, Susanne Scott and Laurene E. Simms, "The 'Why' and 'How' of an ASL/English Bimodal Bilingual Program," Accessed July 2018, http://www3.gallaudet.edu/Images/Clerc/articles/Odyssey_SPR_2012_NussbaumScottSimms.pdf (2012).

48 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

49 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

50 In the baseline teacher questionnaire administered in December 2017, 11 respondents (84.6 percent) said they had no official certification in teaching.

51 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

52 United Nations Convention on the Rights of Persons with Disabilities, art. 24

53 World Federation of the Deaf, "WFD Position Paper on the Language Rights of Deaf Children," accessed July 2018. https://2tdzpf2t7hxmggqhq3njno1y-wpengine.netdna-ssl.com/wp-content/uploads/2017/01/WFD-Position-Paper-on-Language-Rights-of-Deaf-Children-7-Sept-2016.pdf (2016).

54 RTI International, *Situation and Needs Assessment for Students Who are Blind/Low Vision or Deaf/Hard of Hearing in Morocco* (Washington, D.C.: United States Agency for International Development), accessed July 2018, https://ierc-publicfiles.s3.amazonaws.com/public/resources/Morocco%20Inclusion%20Study%20Report%20ENGLISH.pdf.

IV. Project Description

IDRT is a for-profit organization focused on improving the lives of people with disabilities, their families, and their service providers through research and development, training, technical assistance, and advocacy. It has worked for more than 30 years in the creation and provision of assistive technologies for people with disabilities. IDRT has expertise in the development of computer software that is accessible in American Sign Language (ASL). The multidisciplinary research team—Ingénierie Linguistique, Technologie et Handicap—at ENSMR has extensive experience in natural language processing and computer linguistics.

IDRT and ENSMR began their collaboration in 2012 under the Partnerships for Enhanced Engagement in Research (PEER) Program Cycle 1, funded by USAID and the National Science Foundation.[55] The organizations leveraged PEER funding to create an assistive technology that could serve as an instructional tool and provide real-time translation between MSL and MSA.[56] IDRT and ENSMR received additional funding through PEER in 2014 to continue work on the assistive technology, specifically related to science, technology, engineering, and mathematics education.[57]

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project, funded by ACR GCD Round 2, built on previous work and technologies created by IDRT and ENSMR in Morocco. The project consisted of four core activities:

1. Development of software that helps teachers and parents create and publish MSL-supported educational materials and development of an "introduction to MSL" software
2. Training of teachers, parents, government officials, Deaf association representatives, and other stakeholders on how to use the software and on reading instruction techniques appropriate for young children who are deaf or hard of hearing
3. Support for the activities of a steering committee whose goal is to improve the education of children who are deaf or hard of hearing in Morocco
4. Design and implementation of a reading and sign language assessment for students who are deaf or hard of hearing

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project worked in ten schools in Morocco—nine private education centers exclusively for students who are deaf or hard of hearing and one public general education school with an integrated classroom—and reached 233 students in Grades 1 and 2.[58] Project staff in Morocco and USAID/Morocco worked to select schools in a variety of regions across the country to include in the project.[59]

As part of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project, IDRT developed *MSL Clip and Create*, which is based on a similar software IDRT produced for ASL instruction. *MSL Clip and Create* addresses the challenges faced by teachers of students who

55 The PEER program is an international grants program that "funds scientists and engineers in developing countries who partner with U.S. government-funded researchers to address global development challenges." See http://sites.nationalacademies.org/PGA/PEER/PGA_069374.

56 The National Academies of Sciences, Engineering, and Medicine, "Partnership for Enhanced Engagement in Research (PEER) Science: Assistive Technology for Improving Literacy Among the Deaf and Hard of Hearing," accessed July 2018, http://sites.nationalacademies.org/PGA/PEER/PGA_069374.

57 The National Academies of Sciences, Engineering, and Medicine, "Partnership for Enhanced Engagement in Research (PEER) Science: Tools and Resources to Improve Deaf Educational Access to Science, Technology, Engineering, and Mathematics," accessed July 2018, http://sites.nationalacademies.org/PGA/PEER/PEERscience/PGA_152065.

58 IDRT provided software and training to ten schools, although only eight schools participated in the research study. See Research Population.

59 The project did not provide any specific selection criteria for schools' inclusion in the project.

are deaf or hard of hearing related to the time-intensive creation of sign-language supported instructional materials. The first software version, released in October 2016, contained a dictionary of more than 1,500 signs in MSL. The second version, released in January 2018, contained nearly 3,000 signs including regional variations. Each dictionary entry contains a large graphic depiction of the sign, the corresponding word in MSA, and a clip art image of the concept. There is also a corresponding video clip of the sign being produced by an individual, as well as the sign's definition in written MSA and in an MSL video clip. The software has a publisher function that allows users to create their own print materials using any of the graphics in the database, as well as to import other graphics and photos or insert text. IDRT developed customizable templates available in the software; these include crossword puzzles, word searches, SIGN-O cards, flashcards, fingerspelling scrambles, and matching games.[60] The software also contains recommended instructional strategies and six stories in MSL.[61] IDRT rolled out three different versions of the software during the project. Each version featured improved functionality, built upon feedback from participants, and included new vocabulary, such as regional variations collected across the different regions of Morocco.

In December 2016, IDRT staff visited each of the ten project schools to distribute *MSL Clip and Create* to all Grade 1 and 2 teachers. IDRT provided each teacher with a computer loaded with Windows 10, Microsoft Office, and antivirus protection software; a keyboard and monitor; a printer; and a projector. During this visit, IDRT also provided training on basic computer literacy and the use of *MSL Clip and Create*. Additional training was provided to schools in January 2017 to reinforce topics introduced in the initial school visits and provide additional instruction on the different functionalities of *MSL Clip and Create*. The IDRT team addressed hardware or software technical issues during this visit.

IDRT held their first reading instruction training in Rabat in May 2016 led by three U.S.-based experts: Dr. Corinne Vinopol, president and chief executive officer of IDRT and an expert in Deaf education; an additional expert in Deaf education; and a clinical audiologist. In attendance were school directors and teachers from ten schools, social workers, MNE representatives, and USAID staff members. Over three days, participants learned about social and cultural issues related to children who are deaf or hard of hearing, causes of hearing loss, types of auditory devices available for children and adults, cognitive and language development of children who are deaf or hard of hearing, and teaching strategies for children who are deaf or hard of hearing.

A second training was held in Rabat in December 2017 for teachers and Deaf Community members. Facilitated by IDRT staff and trainers with expertise in Deaf education, the training provided participants with information on optimizing physical space, project-based instruction techniques, and bilingual teaching strategies. It also afforded the opportunity to discuss teaching challenges and solutions. At times during the training, teachers and Deaf Community members participated in separate concurrent training sessions targeting skills needed to improve bilingual classroom instruction and enhance collaboration. For example, Deaf Community members worked on MSL storytelling techniques while teachers worked on incorporating bilingual instruction strategies into lesson plans. Then they jointly created lesson plans using stories the Deaf Community members had videotaped.

From April 2 to 6, 2018, four U.S.-based trainers—three of whom are deaf—visited project schools to observe instructional practices and provide individualized coaching. Following these visits, IDRT held a national training for teachers and Deaf Community members in Rabat from April 8 to 11, 2018. The purpose of this training was to address the importance of differentiated instruction for students who are deaf or hard of hearing. Attendees participated in activities to support their understanding and application of new topics, skills, and strategies, and enhance their skills in MSL.

60 SIGN-O cards, similar to Bingo cards, are customizable game cards to help students learn vocabulary words.

61 The story-builder function allows students to read a story in MSA with accompanying illustrations and watch a video of the story being signed in MSL.

The project supported the creation of a steering committee comprised of members of Deaf associations in Morocco, with the goal of addressing the most important issues in Deaf education in collaboration with the MNE. The first meeting was held in February 2016 and continued through February 2018; the committee held nine meetings in total, each in a different region of Morocco. The content of the meetings consisted of project-related issues as well as broader issues in Deaf education in Morocco.

Finally, STS, with support from IDRT, developed an EGRSLA to assess MSA and MSL skills of students who are deaf or hard of hearing who participated in the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project. STS and IDRT piloted the EGRSLA in October and November 2016, collected baseline data in December 2017 and January 2018, and collected endline data in May 2018 (see EGRSLA Instrument and Protocols).

Photo: École Nationale Supérieure des Mines de Rabat in Morocco

V. Research Purpose and Design

The goal of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project was to improve the reading skills of students who are deaf or hard of hearing. The primary research question explored through the project evaluation was:

1. How did the MSA reading skills and MSL comprehension of students whose teachers had access to the *MSL Clip and Create* software change over the course of an academic year?

STS also sought to answer the following supplemental research questions common to all ACR GCD grantees:

2. How successful was the rollout of the project?
3. How did the project influence or impact adults'—teachers, parents, community members—knowledge, skills, or attitudes regarding children's ability to learn to read and sign?
4. How did the project influence certain subsets of the student population more than others, based on identifiable contextual factors?

To answer these research questions, STS and IDRT collected EGRSLA data twice during the project.[62] Baseline data were collected in December 2017 and January 2018, and endline data were collected in May 2018. Because the context did not allow for the creation of comparable control group, a reflexive-comparison design was used. This allowed the intervention group's results to be compared at baseline and endline as a way of understanding the extent to which the intervention may have led to its intended result, although it does not allow for the isolation of gains associated with the project versus those from an additional five months of schooling (see Limitations). Qualitative data were collected to answer ACR GCD's supplemental research questions.

EGRSLA Research Population

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project was implemented in ten schools throughout Morocco. STS and IDRT conducted data collections in eight of the ten schools; two schools were not included in the research study due to data collection and administrative challenges. The research study sample consisted of all students in Grades 1 and 2 from the eight schools. The number of students included in this analysis are detailed in Table 1. At baseline, 143 students were assessed, and at endline, 133 students were assessed. Ten students were not assessed at endline due to dropouts or medical issues.

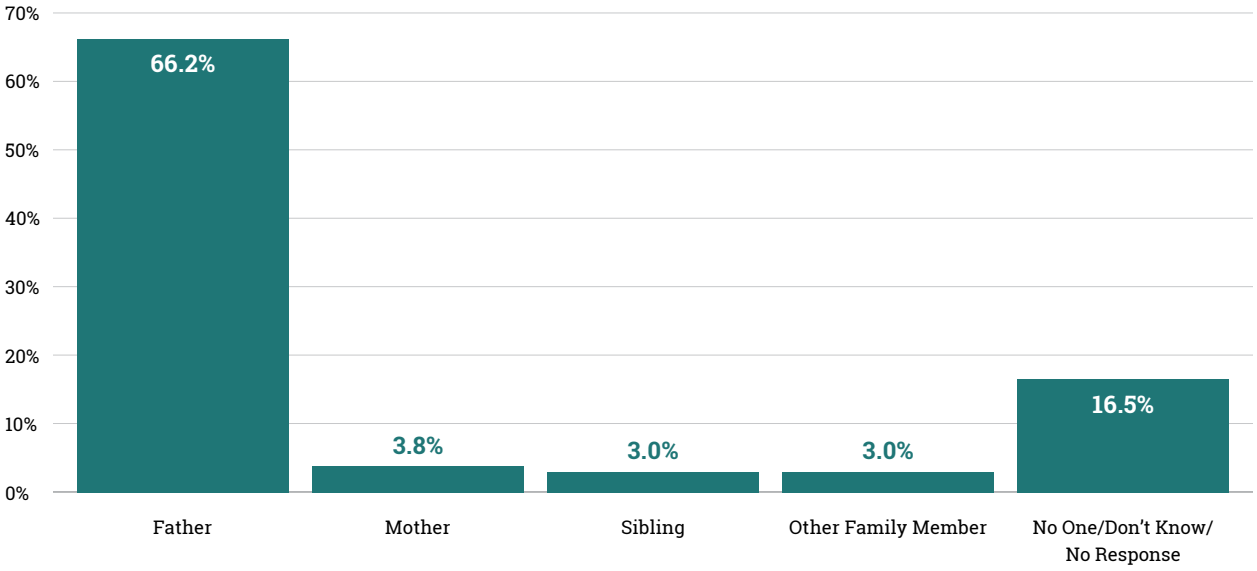
Table 1: **Number of Students Assessed by Gender and Grade at Endline**

Sample Characteristics	Girls	Boys	Total
Grade 1	19 (30.6%)	43 (69.4%)	**62 (100.0%)**
Grade 2	30 (42.3%)	41 (57.7%)	**71 (100.0%)**
Total	**49 (36.8%)**	**84 (63.2%)**	**133 (100.0%)**

62 STS developed an initial version of the EGRSLA in October 2016 during an adaptation workshop and piloted the instrument in eight schools. Following the pilot, a dissemination workshop in January 2017, and site visits in May 2017, STS updated the EGRSLA instrument.

The mean age of grade 1 and 2 students at baseline was 10.8 and 12.4 years, respectively.[63] The youngest grade 1 student was 6 years old at baseline, and the oldest was 17. The youngest grade 2 student at baseline was 8, and the oldest was 19 (Annex Table E. 4). Figure 3 shows the proportion of students who reported having a family member who is deaf or hard of hearing. Among students with a family member who is deaf or hard of hearing, the highest proportion reported having a father who is deaf or hard of hearing—66.2 percent. Out of the 133 students sampled, 22 (16.5 percent) said they did not have a family member who is deaf or hard of hearing, did not respond, or responded that they did not know.

Figure 3: **Proportion of Students with Family Members Who Are Deaf or Hard of Hearing**



Of the 133 students assessed, 62.4 percent said at baseline that they learned to sign at school, and 21.8 percent said they learned at home (Annex Table E. 3).[64] Most students—59.4 percent—said they did not know how old they were when they learned to sign; 17.3 percent learned between ages two and six and 19.5 percent learned between ages seven and 11 (Annex Table E. 3). The remaining 3.8 percent learned sign language when they were between 12 and 15 years old.

Nine of the schools involved in the project are operated directly by private organizations or Deaf associations and specifically serve students who are deaf or hard of hearing. One is a government-run, public, general education school that offers integrated classrooms and specialized teachers for students who are deaf or hard of hearing; however, it does not offer options for mainstreaming those students into other classrooms. Because of the lack of MNE oversight and the decentralized approach to education for students who are deaf or hard of hearing, there is significant heterogeneity in the teachers' backgrounds, pedagogy, school resources, materials availability, and personnel capacities in MSL across the schools. At five of the eight schools included in the EGRSLA research population, there were no teachers or teachers' aides who are deaf at baseline; three of the eight schools reported having multi-grade classrooms. The total number of students across the eight schools ranged from 13 to 167, and half of the schools are housed in or immediately adjacent to a public school (Annex Table E. 2).

63 Of the 62 grade 1 students, 40.3 percent did not know or did not respond when asked their age. Of the 71 grade 2 students, 15.5 percent did not know or did not respond when asked their age.

64 15.8 percent of students responded they did not know or did not respond to the question.

End-of-Project Interview Research Population

STS conducted EOP interviews from April 30 through May 21, 2018, with school directors, teachers, teachers' aides, family members, steering committee or Deaf association members, project staff, MNE representatives, and USAID representatives from Morocco and Washington, D.C. EOP interview research population details are provided in Table 2.

Table 2: **EOP Qualitative Interview Sample**[65]

Type of Interview	*N*			Description
	Female	Male	Total	
School director	1	7	8	Seven school directors and one school vice-director
School teacher	23	1	24	19 teachers—including three preschool teachers and one art teacher—and five teachers' aides
Family member	9	3	12	Nine mothers, two fathers, and one brother
Steering committee or Deaf association member	0	7	7	Five steering committee members who serve also as school directors, one association member president, and one association member president who also served as a steering committee member
Project management	1	2	3	One U.S.-based staff member and two Morocco-based staff members
Stakeholder	1	3	4	Two USAID/Morocco representatives, one USAID/D.C. representative, and one MNE representative

STS determined the research population for EOP interviews in collaboration with IDRT and USAID. STS conducted interviews in nine of the ten schools where the project was implemented; STS spoke with all of the school directors, teachers, and teachers' aides who were present on the day of the visit. In the majority of schools, the school director was also a member of the Deaf association and a member of the project's steering committee. Parents were purposively selected by schools for interviews, and STS was not informed of the selection criteria for these invitations. STS purposively selected Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project staff members for interviews. USAID/Morocco identified Moroccan governmental stakeholders for interviews.

Overall, eleven respondents self-identified as deaf or hard of hearing—five teachers, two teachers' aides, two parents, and one Deaf association member—including two men and six women.

65 School directors, steering committee members, and Deaf association members were often the same respondent. The sample sizes in Table 2 do not represent unique respondents and should not be added.

VI. Data Collection Instruments, Fieldwork Preparation, and Data Collection

Instrument development for the EGRSLA began in 2016, and data collections took place across three time periods: pilot, baseline, and endline. Initially, the pilot data collection was intended to serve as the baseline. However, delays in project implementation and a project extension, as well as identified challenges with the data collection instruments and the scoring of regional variations, required STS to add an additional data collection. The same EGRSLA and MSL vocabulary assessment instruments were administered at baseline and endline.

EGRSLA Instrument and Protocols

To assess the literacy skills of students in the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project, STS, an expert in measurement of the literacy of children who are deaf or hard of hearing, and IDRT collaborated with stakeholders from USAID, MNE, and Moroccan Deaf associations to develop a bilingual MSA-MSL assessment during an adaptation workshop in October 2016. The assessment team used an existing MSA EGRA, developed for use by students who are hearing in Morocco in 2015, as the basis for the adapted instrument. The content and administration protocols for each subtask were reviewed and modified for MSL administration. In each subtask, students demonstrate their MSA reading ability through MSL, which means that all subtasks require bilingualism. In other words, to be successful, students must see a written item in MSA, understand the item, and produce the correct corresponding sign in MSL. Fingerspelling of items was only allowed on the letter name identification and syllable identification subtasks and for proper nouns on the reading passage subtask.

After the analysis of the EGRSLA pilot data from 2016, STS presented results to MNE representatives and school directors, and attendees raised valid concerns over the selection of test content and scoring protocols. Specifically, school directors noted that the results misrepresented students' abilities because test administration protocols did not take into account the range of regional variations used for specific words, for the MSL comprehension subtask and for scoring across the other subtasks. As a result of this feedback, STS and IDRT conducted site visits to participating schools to collect regional MSL variations, familiar words, and level-appropriate stories to include in a revised EGRSLA. STS and IDRT subsequently led a validation workshop with stakeholders in December 2017 to review and finalize the updated instrument. The final EGRSLA instrument includes six subtasks:

1. Letter name identification (timed)
2. Syllable identification (untimed)
3. Familiar word reading (timed)
4. Reading passage (timed)
5. Reading passage comprehension (untimed)
6. MSL comprehension (untimed)

Based on guidance from literacy and Deaf education experts, students were allowed two minutes (instead of the standard one minute) for all timed EGRSLA subtasks. Assessors provided all instructions to students in MSL, and all regional-specific MSL signs were scored as correct.[66] All subtasks—with the exception of the MSL comprehension subtask—were video recorded so that assessors could rescore their assessments at the end of each day. This accommodation was allowed for two principal reasons. First, it allowed assessors to ensure the

66 MSL contains many regional variations for specific words. The project attempted to capture these variations of frequent words to be included in the software provided to teachers including posting a mechanism online through which individuals could contribute regional variations to the software database. Through this approach, 110 regional sign variations were captured. These variations represent what students encounter in their different learning environments.

accuracy of scoring for students who signed quickly enough for it to be difficult to score live. Second, because many of the items on the assessment have regional variations, it allowed assessors to review the signs produced by students to verify their correctness and eliminated the necessity for assessors to memorize all regional signs for items on the EGRSLA.

Analysis indicated a strong relationship between EGRSLA subtasks at both baseline and endline (Annex C).

Additional Instruments

In addition to EGRSLA, assessors administered an MSL vocabulary assessment in which a student was shown a video clip of a level-appropriate vocabulary word in MSL that could not be identified through an iconic sign representation. Then the assessor presented four clip art images, and the student was instructed to point to the image that was represented in the video clip. This subtask assessed students' receptive MSL skills and is used as a complement to the EGRSLA, as it does not require bilingualism. There were ten items on this subtask.

During the baseline data collection, IDRT staff and assessors also captured contextual data through a Snapshot of School Management Effectiveness (SSME) survey, a teacher questionnaire administered on paper, and a student questionnaire administered in Tangerine® at the end of the EGRSLA.[67] Teachers responded to an endline questionnaire administered on tablets in April and May 2018.

Institutional Review Boards

Institutional review boards (IRBs) are responsible for ascertaining the acceptability of proposed research regarding institutional commitments and regulations, applicable laws, standards of professional conduct and practice, and ethical and societal norms. IRBs examine subject recruitment procedures, proposed remuneration, and the informed consent process. IRBs also evaluate the potential risks and benefits to participants outlined in each protocol.

According to the Common Federal Policy for Protection of Human Subjects, education research involving children and "mentally disabled individuals" are covered by USAID's standards for the protection of human research subjects. For this reason, no independent IRB approval was sought by the project.[68]

Pilot Data Collection

During the EGRSLA adaptation workshop in October 2016, assessors pretested EGRSLA instruments in two schools. Following the pretest, STS and workshop attendees agreed upon the necessary changes to the instruments, and STS updated and finalized all data collection instruments. On October 17 and 18, STS led an assessor training for the pilot, and assessors collected data from October 25 to November 14, 2016 (see Table 3). The pilot sample consisted of 155 students in Grades 1 and 2 from eight schools across Morocco. Because the pilot was initially expected to be the baseline, schools were selected based on where IDRT intended to implement the project.

67 Tangerine® is an electronic data collection software designed for use on mobile computers, including netbooks, tablet computers, and smartphones. Its primary use is to enable recording of students' responses in oral early grade reading and mathematics skills assessments, specifically EGRA and Early Grade Mathematics Assessment, and interview responses from children, teachers and principals on home and school context information (http://tangerinecentral.org/).

68 United States Agency for International Development, *Protection of Human Subjects in Research Supported by USAID: A Mandatory Reference for ADS Chapter 200*, (Washington, D.C.: United States Agency for International Development, 2006), accessed July 2018, https://www.usaid.gov/sites/default/files/documents/1864/200mbe.pdf.

Baseline Data Collection

STS led a five-day assessor training from December 11 through 15, 2017. IDRT identified two assessors—one female and one male—to participate in the baseline data collection. One of the assessors, who is hard of hearing and fully fluent in MSL, participated as an assessor in the 2016 EGRSLA pilot, and the second assessor, who is deaf and fully fluent in MSL, had no previous experience administering EGRSLA, EGRA, or any other standardized assessments.[69] The training was led by three STS team members, and the participants included the two assessors, who administered the EGRSLA, and one IDRT team member, who administered the SSME and teacher questionnaire. Representatives from USAID attended some of the training to provide feedback and guidance on assessment decisions and training needs.

Table 3: **Fieldwork Preparation and Data Collection Timeline**

Task	Dates
EGRSLA instrument adaptation workshop and pre-test	October 3–7, 2016
EGRSLA pilot assessor training	October 17–18, 2016
EGRSLA pilot data collection	October 25–November 14, 2016
EGRSLA instrument validation workshop	December 7–8, 2017
EGRSLA baseline assessor training	December 11–15, 2017
EGRSLA baseline data collection	December 18, 2017–January 8, 2018
EOP interviews	April 30–May 12, 2018; May 21, 2018
EGRSLA endline assessor refresher training	May 10–11, 2018
EGRSLA endline data collection	May 14–30, 2018

The first three days of the training consisted of an in-depth review of the assessment and subtask protocols, practice administering the assessment, and determinations of who would administer which parts of the assessment. Ultimately, one assessor was assigned to administer the letter sound identification, syllable identification, familiar word reading, reading passage, and reading passage comprehension subtasks to all students. The other assessor was assigned to administer the MSL vocabulary, MSL comprehension, and student questionnaire to all students. This decision ensured internal assessor reliability on each subtask, and it allowed each assessor to master the instructions and familiarize themselves with all acceptable regional variations and scoring protocols for their assigned subtasks.

On the fourth day of the training, assessors practiced administering the EGRSLA in a nearby school with four Grade 3 and 4 students who are deaf or hard of hearing.

Operational baseline data collection commenced on December 18, 2017, after the assessor training. The assessor team spent an average of two days per school to administer the EGRSLA and additional instruments. The team revisited two schools to assess students who were absent during the initial data collection. Data collection finished on January 8, 2018, and a total of 143 students—55 girls and 88 boys—were assessed.

69 One assessor is hard of hearing and serves as an interpreter for students who are deaf. The other assessor is deaf and serves as a teacher's aide at one of the project schools.

Photos: School-to-School International

Endline Data Collection

Prior to endline data collection, STS conducted a two-day assessor refresher training on May 10 and 11, 2018. The training consisted of a review of all EGRSLA and MSL vocabulary assessment subtask items and protocols, general administration protocols, and multiple rounds of practice with feedback. The same two assessors from baseline participated in the training and were assigned to administer the same subtasks at endline as they did at baseline.

Operational data collection at endline began on May 14, 2018 and ended on May 30, 2018. Assessors collected data in eight schools, and a total of 133 students—49 girls and 84 boys—were assessed.

Assessor Accuracy and Interrater Reliability

Assessors generally undergo assessor accuracy testing to determine the extent to which different assessors agree in their scoring on the same observation. This is accompanied by the collection of interrater reliability (IRR) observations during operational data collection to ensure the reliability and consistency of data and prevent assessor drift.[70] Because there were only two assessors for the EGRSLA at baseline and endline, and because each assessor was responsible for specific subtasks, neither assessor accuracy nor IRR testing were conducted. The assignment of specific subtasks to each of the two assessors ensured internal assessor reliability in the absence of these other measures.

End-of-Project Interview Data Collection

STS conducted EOP interviews from April 30 through May 12, 2018, in Morocco and on May 21, 2018, in Washington, D.C. The goal of these interviews was to explore how the project influenced or impacted adults'—teachers, parents, community members—knowledge, skills, or attitudes regarding children's ability to learn to read and sign, the perceived impact of the project, and the outstanding issues facing students in Morocco who are deaf or hard of hearing as well as their families and educators. EOP interviews were conducted with six types of respondents: school directors, school teachers, parents, steering committee members, project management, and government stakeholders. STS conducted interviews using an English-Arabic interpreter and, when appropriate, an Arabic-MSL interpreter. Although interviews were not recorded, in most cases one STS team member facilitated the interview while the second team member took detailed notes.

All interviews were semi-structured and guided by a set of open-ended questions that were explored to different extents by the interviewers. School directors, steering committee members, and Deaf association members responded to 16 questions related to their role in the schools and associations, involvement with the project, perceptions of the impact of the project, and recommendations for future initiatives to support students who are deaf or hard of hearing.[71] All interviews were conducted with a single respondent at a time.

STS asked teachers and teachers' aides 21 open-ended questions related to their teaching backgrounds, interaction with the project, perceptions of the impact of the project, and recommendations for future initiatives to support students who are deaf or hard of hearing. In three schools, STS conducted group interviews with teachers and teachers' aides. In one of the three schools, teachers and teachers' aides were split into two separate groups. All other interviews were conducted with a single respondent at a time. There were a total of 24 teachers and teachers' aides interviewed, including 19 teachers and five teachers' aides, of whom 23 were female and one was male.

70 RTI International, *Early Grade Reading Assessment (EGRA) Toolkit: Second Edition*, (Washington, D.C.: United States Agency for International Development, 2016).

71 In the majority of schools, the respondent interviewed held more than one of these positions. STS included or removed specific questions depending on a respondent's different position.

Nine mothers, two fathers, and one brother participated in family member interviews, which consisted of 15 open-ended questions about their experiences as relatives of children who are deaf or hard of hearing, their engagement with their child's or sibling's learning, and the support they recommend to improve education for students who are deaf or hard of hearing. In one school, STS conducted a group interview instead of single respondent interviews.

Project management interviews consisted of 25 open-ended questions related to general information about the project, strengths and challenges of project design and implementation, perceptions of the impact of the project, and recommendations for future initiatives to support students who are deaf or hard of hearing. Staff from IDRT and ENSMR—one female and two males—were interviewed.

STS conducted interviews with three USAID representatives—including two from Morocco and one from Washington, D.C. Two interviews were conducted in person, while the third was conducted over email. Interviews were guided by 11 questions about USAID's work supporting students who are deaf or hard of hearing internationally and locally, perceptions of the impact of the project, and current and future policies that could improve education for students who are deaf or hard of hearing.

STS asked 15 questions of the MNE representative, which were similar to those asked of USAID representatives.


Photo: USAID/Morocco

VII. Data Analysis

EGRSLA data were analyzed using Microsoft Excel and IBM SPSS Statistics software. Only students who had data at both baseline and endline were included in the analysis. EGRSLA subtask results were matched by student and compared by time period to calculate reading gains over the life of the project.[72] Subtask fluencies and scores were reported with mean scores and standard deviations (SD) relevant to those mean values.[73, 74] Zero scores were also calculated for all subtasks.[75] Differences between students' scores at baseline and endline were tested for statistical significance using paired t-test analysis.[76] Differences in the proportion of zero scores were tested for significance using McNemar's test and the chi-square test.[77] Results with statistically significant differences are reported throughout the report with an asterisk, plus-sign, or caret. Where results are not statistically significant, it is not possible to assume that there is any difference between groups.

For each subtask, decision rules were applied to assess whether outliers would need to be removed. For example, if the time remaining for a timed subtask resulted in a fluency rate that was outside a reasonable range, then that student's fluency rate was not included in the analyses. Reasonable ranges for the time remaining were based on multiple factors, including the rate at which letters or words in the language tested are typically read, the distribution—or relative performance—of students in the sample, and the mean fluency rate with and without the outlier data point(s). After consideration of the scoring and timing ranges, it was determined that all cases were reasonable; no outliers needed to be removed.

Table 4 provides details on the EGRA subtasks, including how results were calculated.

72 Because of rounding, mean changes reported may not always equal endline value minus baseline value.

73 Fluency rates were calculated for all timed subtasks per second and multiplied by two minutes to compute the rate per two minutes. This calculation considers the amount of time remaining and assumes that, if there were additional items included on the timed subtask, the child would have continued responding at the same rate. As a result, for some subtasks, average fluency rates were higher than the number of items on the subtask.

74 SD describes how much observed values vary from the mean. A smaller SD indicates that most values are close to the mean; a larger SD indicates that values are further from the mean. This report provides mean fluencies and scores of the entire sample of students participating in the project. SDs are listed to understand the variability of the scores within the sample.

75 Students receive a zero score if they are unable to correctly identify a single item on a subtask. In this report, zero scores are shown as the number of students or as the total percentage of students unable to correctly identify a single item on a subtask.

76 A paired t-test calculates the difference within each before-and-after pair of measurements, determines the mean of these changes, and reports whether this mean of the differences is statistically significant. Due to the dependent nature of the subtask scores at baseline and endline (each collected from a single student), a paired sample t-test was determined to be most appropriate.

77 McNemar's test is a statistical test comparing paired, dichotomous data in order to understand consistency across variables. Here, it is used to determine if the proportion of students with zero scores at baseline compared to endline deviates from what is expected. The chi-square test is a statistical test comparing proportion of students with zero scores that were observed in the data against what was expected.

Table 4: **EGRSLA Subtask Details and Data Analysis Method**

Subtask	Type	Number of Items	Analysis
Letter name identification	Timed	100	Letter name identification is measured as correct letter names signed per two minutes (CLNP2M). Letter name identification is a measure of alphabet knowledge and is highly predictive of later reading achievement. Each student had two minutes to sign up to 100 letters. If a student was unable to sign the first ten letters correctly, the subtask auto-stopped.
Syllable identification	Untimed	25	Syllable identification is measured as the number of correct syllables signed out of 25. Syllable identification is a measure of knowledge of the letter combinations and is a more advanced predictor of decoding ability.
Familiar word reading	Timed	50	Familiar word reading is measured as the number of correct familiar words signed per two minutes (CFWP2M). Familiar word reading measures word recognition and decoding. Each student had two minutes to read and sign up to 50 high-frequency words. If a student was unable to correctly read and sign the first ten familiar words, the subtask auto-stopped.
Reading passage	Timed	46	The reading passage is measured as correct words signed per two minutes (CWP2M). The reading passage subtask—similar to the oral reading passage on the EGRA—is a measure of reading fluency, reading accuracy, and the ability to produce the accompanying signs. Each student had two minutes to read and sign up to 46 words. If a student was unable to correctly read and sign the first five words in the passage, the subtask auto-stopped. The reading passage formed the textual basis for the reading passage comprehension subtask.
Reading passage comprehension	Untimed	5	Reading comprehension is measured as the number of correct answers signed to the assessor based on questions asked about the passage read as part of the reading passage subtask. Each student had the opportunity to answer up to four factual questions and one inferential question. The number of comprehension questions asked to students is dependent on the amount of text read and signed in the reading passage question.
MSL comprehension	Untimed	5	MSL comprehension is measured as the number of correct answers signed to the assessor based on a videoed story that students watched. Each student had the opportunity to answer four factual questions and one inferential question.

In addition to the subtasks in the EGRSLA, data from the MSL vocabulary assessment, SSME instrument, teacher questionnaire, and student questionnaire were analyzed.

Limitations

Lack of Comparison Group

The research design for this project—a reflexive-comparison—did not include a comparison group. The purpose of comparison groups is to provide a counterfactual measure or a measure of changes that occurred in the absence of a project or intervention. As a result, the findings of this report should be understood as the changes that occurred from a combination of the project and an additional five months of schooling. It is not possible to fully isolate how much of the measured change from baseline to endline is due to the project and how much is due to additional schooling.

Timing of Baseline and Endline

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project introduced the *MSL Clip and Create* software into grade 1 and 2 classrooms in intervention schools in December 2016. Because of this, it is likely that students who attended classes in the 2016–17 academic year were exposed to the software prior to the baseline assessment in December 2017 and January 2018. Baseline results presented in this report may account for this exposure.

STS utilized the same EGRSLA instrument to allow for comparability between baseline and endline, and there were four months between the administrations of the EGRSLA. Although unlikely, it is possible that student endline scores are conflated with recall of the assessment content.

Sampling Approach and School Variation

Results presented in this report should be understood within the context of the system of education supporting deaf and hard of hearing students in Morocco. The project worked with nine private education centers exclusively for students who are deaf or hard of hearing and one public general education school with an integrated classroom. No specific selection criteria were documented to justify the selection of these schools. Significant heterogeneity was observed in the teaching methods, pedagogy, school resources, materials availability, and personnel capacities in MSL across schools. Additionally, as the study included a purposive sample of eight schools participating in the project, the results cannot be generalized to the greater population of students who are deaf or hard of hearing in Morocco.

Moroccan Sign Language Regional Variations

MSL has significant dialectal variation across the different regions of Morocco. During the pilot test of the EGRSLA, it was evident that, in addition to their reading skills, students' performance on the assessment was highly conditional on their ability to understand assessors' dialect and on the assessors' ability to accurately score student responses given regional variations. Following the pilot test, the project and STS revised the EGRSLA instrument to reduce the potential for regional variations to impact performance on the assessment. Project staff developed and filmed a new MSL comprehension story that contained minimal MSL regional variations. Project staff then had local stakeholders from each region review the MSL comprehension video story and confirm that the MSL in the video accurately represented their dialect of MSL. Further, in advance of the baseline assessment, assessors reviewed all potential regional variations of items on the letter name identification, syllable identification, familiar word reading, and reading passage subtasks to ensure that students who signed a correct regional variation would be marked correct. These subtasks were also filmed to allow both assessors, who are from two different regions of Morocco, to review students' assessments as needed to correctly rescore any regional variations.

Despite these accommodations, it is possible that regional variations have not fully been accounted for in the assessment and scoring protocols. This should be taken into account when considering the results of the EGRSLA.

MSL Comprehension Question Two

During the endline assessor refresher training, assessors realized that the second MSL comprehension question contained a mismatch between what was signed in the video shown to students and the MSA translation of the question visible to the assessor in Tangerine. Specifically, the videoed question translated to "What did the children drink?" while the MSA translation of the question in Tangerine was "When did the children have drinks?" The text in Tangerine was updated in the endline assessment to accurately reflect the videoed question. It is unlikely that this inconsistency had an impact on student scores on the MSL comprehension subtask at baseline, as the assessor scored a response as correct or incorrect based on the videoed question.


Photo: USAID/Morocco


Photo: Institute for Disabilities Research and Training


Photo: School-to-School International

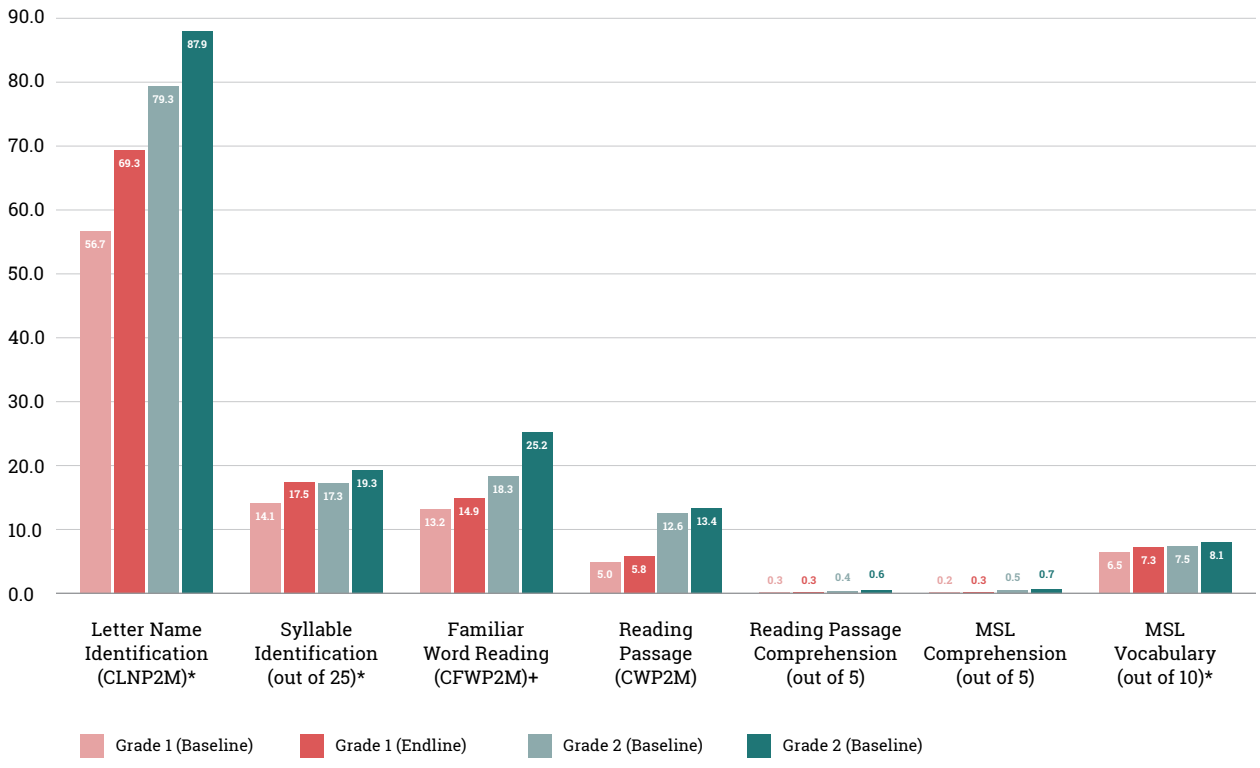
VIII. EGRSLA and MSL Vocabulary Assessment Results

This section presents EGRSLA and additional quantitative results to understand whether the reading and MSL skills of grade 1 and grade 2 students in the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project increased over a period of four months.[78] Specifically, this section answers two research questions: *How did the MSA reading skills and MSL comprehension of students whose teachers had access to the MSL Clip and Create software change over the course of an academic year?* and *How did the project influence certain subsets of the student population more than others, based on identifiable contextual factors?*

The following section contains findings across EGRSLA subtasks and the MSL vocabulary assessment as well as detailed results by grade. Results are also explored by gender, followed by details on project dosage.

Figure 4 presents results for students by grade and timepoint. Overall, students showed improved reading skills at endline. Students in grades 1 and 2 achieved statistically significantly higher scores on the letter name identification and syllable identification subtasks and on the MSL vocabulary assessment at endline compared to baseline. Grade 2 students also achieved statistically significantly higher average scores at endline over baseline on the familiar word reading subtask.

Figure 4: **EGRLSA and MSL Vocabulary Assessment Mean Scores by Grade and Timepoint**

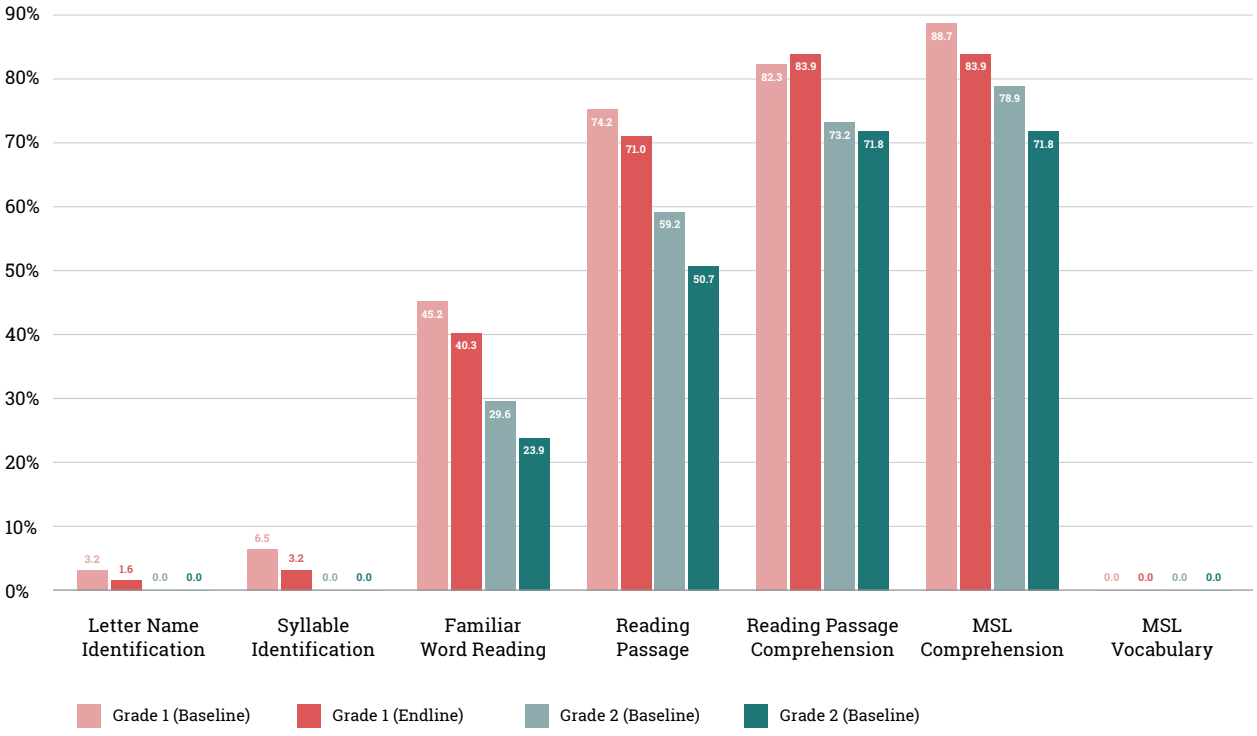


Note: G1 *n* = 62; G2 *n* = 71. An asterisk (*) indicates the average scores for the baseline and endline EGRSLA were statistically significantly different at p<0.05 for both grades. A plus (+) indicates the average scores for the baseline and endline EGRSLA were significantly different at p<0.05 for only grade 2.

78 The project began in October 2015 and will end in October 2018. The baseline and endline results presented in this report are from the academic year 2017–18.

Figure 5 presents the percentage of students receiving zero scores by EGRSLA subtask by grade and timepoint. The total proportion of grade 1 and grade 2 students receiving zero scores decreased from baseline to endline assessment on all subtasks except reading passage comprehension, where 1.6 percent more Grade 1 students were unable to answer a single question correctly at endline than at baseline. No statistically significant difference in the proportion of zero scores was observed between timepoints on any subtask for either grade.[79]

Figure 5: **Percentage of Students Receiving Zero Scores by Grade and Timepoint (%)**



Note: G1 *n* = 62; G2 *n* = 71.

EGRSLA Results by Subtask

Letter Name Identification

The letter name identification subtask measures students' knowledge of the alphabet and associated MSL sign and may be associated with later reading success. For this subtask, students were presented with a stimulus of 100 MSA letters and were instructed to fingerspell the sign in MSL for as many letters as they could in two minutes. The subtask was discontinued if a student was unable to correctly name any of the first ten letters of the stimulus. The mean fluency rates, reported as correct letter names signed per two minutes (CLNP2M), are presented in Table 5.

79 The differences between the percentage of students receiving zero scores at baseline and endline were tested for statistical significance using McNemar's test.

Table 5: **Letter Name Identification Fluency (CLNP2M) by Grade**

Group	*N*	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1*	62	56.7	36.0	2 (3.2%)	69.3	33.3	1 (1.6%)	12.6
Grade 2*	71	79.3	40.6	0 (0.0%)	87.9	33.6	0 (0.0%)	8.6

Note: An asterisk (*) indicates the average scores for the baseline and endline EGRSLA were statistically significantly different at p<0.05. No significant difference in proportion of zero scores were observed between timepoints.

The average identification rate for the letter name identification subtask was statistically significantly higher at endline than at baseline in both grade 1 and grade 2. **On average, grade 1 students showed an increase of 12.6 CLNP2M, while grade 2 students showed an average increase of 8.6 CLNP2M.** Overall, only one grade 1 student at endline received a zero score on the subtask.

Syllable Identification

The syllable identification subtask measures students' understanding of how written letter and diacritic combinations in MSA are signed in MSL. For this untimed subtask, each student was presented with a stimulus of 25 syllables and asked to fingerspell the signs that correspond to the letter and diacritic combinations represented in print. Results for the syllable identification subtask are presented in Table 6.

Table 6: **Syllable Identification (Correct out of 25) by Grade**

Group	*N*	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1*	62	14.1	8.1	4 (6.5%)	17.5	7.4	2 (3.2%)	3.4
Grade 2*	71	17.3	6.8	0 (0.0%)	19.3	6.2	0 (0.0%)	2.0

Note: An asterisk (*) indicates the average scores for the baseline and endline EGRSLA were statistically significantly different at p<0.05. No significant difference in proportion of zero scores were observed between timepoints.

The mean score for the syllable identification subtask was statistically significantly higher at endline than at baseline in both grade 1 and grade 2. At endline, grade 1 students correctly signed an average of 17.5 syllables out of 25 possible syllables—an increase of 3.4 syllables over the baseline average. Grade 2 students signed an average of 19.3 syllables correctly at endline—an increase of 2.0 syllables over the baseline average. Overall, two grade 1 students—or 3.2 percent of grade 1 students—were unable to correctly sign a single syllable at endline. No grade 2 students received a zero score at endline on this subtask.

Familiar Word Reading

In the familiar word reading subtask, students were presented with 50 familiar words and asked to sign as many as they could within two minutes. For this subtask, students had to read the word in written MSA, understand the word, and translate it into MSL by producing the corresponding sign.[80] Knowledge of familiar words and the ability to read them quickly enables a student to read with automaticity—a skill critical to learning to read with fluency and comprehension. The subtask was discontinued if a student was unable to sign any of the first ten familiar words correctly. Results for the familiar word reading subtask, reported as correct familiar words signed per two minutes (CFWP2M), are presented in Table 7.

Table 7: **Familiar Word Reading Fluency (CFWP2M) by Grade**

Group	*N*	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1	62	13.2	19.9	28 (45.2%)	14.9	20.6	25 (40.3%)	1.7
Grade 2*	71	18.3	22.3	21 (29.6%)	25.2	23.7	17 (23.9%)	6.9

Note: An asterisk (*) indicates the average scores for the baseline and endline EGRSLA were statistically significantly different at $p<0.05$. No significant difference in proportion of zero scores were observed between timepoints.

The average fluency rate for the familiar word reading subtask was, on average, higher at endline when compared to baseline, though this difference was statistically significant only for grade 2 students. At endline, grade 1 students signed an average of 14.9 CFWP2M—an increase of 1.7 words over the baseline average. Twenty-five grade 1 students—40.3 percent of all grade 1 students assessed—were unable to sign a single familiar word correctly at endline. Grade 2 students signed an average of 25.2 CFWP2M at endline—an increase of 6.9 words over the baseline average. Seventeen grade 2 students—23.9 percent of all grade 2 students—were unable to sign a single familiar word correctly at endline.

Reading Passage

Referred to as the oral reading fluency subtask on spoken-language EGRAs, the reading passage subtask measures students' overall reading ability, which is their ability to read connected text, process connections, relate text to meaning, and make inferences. For the reading passage on the EGRSLA, students were presented with a short, simple text and asked to read the text and produce the corresponding signs in MSL.[81] For this subtask, students had to read the connected text in MSA, understand the meaning of the text, and produce the corresponding signs for the written text in MSL. The passage contained 46 words, and the subtask was discontinued if a student was unable to correctly sign any of the first five words in the passage. Results for the reading passage subtask, reported as correct words signed per two minutes (CWP2M), are presented in Table 8.

80 Fingerspelling of words was marked incorrect on the familiar word reading subtask.

81 Fingerspelling of proper nouns was considered correct on the reading passage subtask, but fingerspelling of all other words was marked incorrect.

Table 8: **Reading Passage Fluency (CWP2M) by Grade**

Group	N	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1	62	5.0	11.1	46 (74.2%)	5.8	12.5	44 (71.0%)	0.8
Grade 2	71	12.6	24.0	42 (59.2%)	13.4	21.1	36 (50.7%)	0.8

The fluency rate for the reading passage subtask was, on average, higher at endline than at baseline, although no statistically significant difference was detected at either grade level. At endline, grade 1 students signed an average of 5.8 CWP2M—an increase of 0.8 words over the baseline average. Forty-four grade 1 students—71.0 percent of all grade 1 students assessed—were unable to correctly sign a single passage word correctly at endline. Grade 2 students correctly signed an average of 13.4 CWP2M—an increase of 0.8 words over the baseline average. Thirty-six grade 2 students—50.7 percent of all grade 2 students assessed—were unable to sign a single passage word correctly at endline.

Reading Passage Comprehension

To assess reading comprehension on the EGRSLA, students were asked up to five comprehension questions based on the text read in the reading passage subtask. Students were only asked questions corresponding to the number of words they read and signed in the passage. Following the reading passage, the assessor signed comprehension questions to students and asked them to respond in MSL. For this subtask, students were required to comprehend the questions signed to them, recall responses from the text that they had read in the reading passage, and respond in MSL to the questions. Results for the reading comprehension subtask are presented in Table 9.

Table 9: **Reading Passage Comprehension (Correct out of Five) by Grade**

Group	N	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1	62	0.3	0.7	51 (82.3%)	0.3	0.7	52 (83.9%)	0.0
Grade 2	71	0.4	0.8	52 (73.2%)	0.6	1.1	51 (71.8%)	0.2

At baseline and endline, grade 1 students correctly answered an average of 0.3 reading comprehension questions out of a maximum of five. At endline, grade 2 students, on average, correctly answered 0.6 reading comprehension questions out of a maximum of five questions—an increase of 0.2 above the baseline average. These changes in the mean scores at each grade level were not found to be statistically significant. Fifty-two grade 1 students—83.9 percent—and 51 grade 2 students—71.8 percent—were unable to answer a single reading comprehension question correctly at endline.

Table 10 presents the frequency of attempted and correct responses to reading passage comprehension questions by grade at endline. Overall, only 35 students—12 grade 1 students and 23 grade 2 students—attempted all five reading comprehension questions. No student in either grade responded correctly to all five questions on the reading comprehension subtask.

Table 10: **Number of Reading Passage Comprehension Questions Attempted and Correct by Grade at Endline**

Type	Number of Questions	Grade 1		Grade 2	
		N	%	*N*	%
Attempted	0	44	71.0%	36	50.7%
	1	1	1.6%	1	1.4%
	2	5	8.1%	3	4.2%
	3	0	0.0%	8	11.3%
	4	0	0.0%	0	0.0%
	5	12	19.4%	23	32.4%
	Total	**62**	**100.0%**	**71**	**100.0%**
Correct	0	52	83.9%	51	71.8%
	1	5	8.1%	6	8.5%
	2	3	4.8%	7	9.9%
	3	2	3.2%	4	5.6%
	4	0	0.0%	3	4.2%
	5	0	0.0%	0	0.0%
	Total	**62**	**100.0%**	**71**	**100.0%**

MSL Comprehension

The MSL comprehension subtask is similar to the listening comprehension subtask on EGRAs for students who have hearing. For this EGRSLA, students watched a video of a short passage signed in MSL and then responded to video-recorded comprehension questions signed in MSL related to the passage.[82] Because the MSL comprehension subtask does not require students to read in MSA and produce corresponding signs in MSL, it is the only subtask on this EGRSLA that does not require comprehension of or bilingualism in MSA. Students were presented with a total of five MSL comprehension questions on this subtask. Results for the MSL comprehension subtask are presented in Table 11.

82 Two versions of the MSL comprehension passage were recorded to accommodate regional variations. Also, two versions of the comprehension questions were produced when the questions contained signs with regional variations. Students were shown the version appropriate for their location.

Table 11: **MSL Comprehension (Correct out of Five) by Grade**

Group	*N*	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1	62	0.2	0.7	55 (88.7%)	0.3	0.8	52 (83.9%)	0.1
Grade 2	71	0.5	1.1	56 (78.9%)	0.7	1.3	51 (71.8%)	0.2

At endline, grade 1 students correctly answered 0.3 MSL comprehension questions out of a maximum of five questions—an increase of 0.1 questions from the baseline average. Grade 2 students, on average, correctly answered 0.7 MSL comprehension questions out of a maximum of five questions at endline—an increase of 0.2 questions above the baseline average. Neither difference was found to be statistically significant. Fifty-two grade 1 students—83.9 percent—and 51 grade 2 students—71.8 percent—were unable to answer a single MSL comprehension question correctly at endline.

Table 12 presents the frequency of correct MSL comprehension questions by grade at endline. No student in grade 1 responded correctly to all five questions on the MSL comprehension subtask, and two students in grade 2 responded correctly to all five questions.

Table 12: **Number of MSL Comprehension Questions Correct by Grade at Endline**

Type	Number of Questions	Grade 1		Endline	
		N	%	*N*	%
Correct	0	52	83.9%	51	71.8%
	1	6	9.7%	6	8.5%
	2	1	1.6%	7	9.9%
	3	2	3.2%	2	2.8%
	4	1	1.6%	3	4.2%
	5	0	0.0%	2	2.8%
	Total	**62**	**100.0%**	**71**	**100.0%**

MSL Vocabulary Assessment Results

All subtasks on the EGRSLA, including the MSL comprehension subtask, are productive, meaning that students need to produce signs in MSL as part of the subtask. To better understand students' language capacities in MSL, a receptive MSL vocabulary assessment was included as a complement to the EGRSLA. For this assessment, a student was shown a video clip of a level-appropriate vocabulary word in MSL with no regional variations. The assessor then presented each student with a stimulus containing four clip art images; the student was instructed to point to the image that was represented in the video clip. There were ten items on this untimed subtask. Results for the MSL vocabulary assessment are presented in Table 13.

Table 13: **MSL Vocabulary (Correct out of 10) by Grade**

Group	*N*	Baseline			Endline			Mean Change
		Mean	SD	Zero Scores (%)	Mean	SD	Zero Scores (%)	
Grade 1*	62	6.5	2.4	0 (0.0%)	7.3	2.1	0 (0.0%)	0.8
Grade 2*	71	7.5	1.8	0 (0.0%)	8.1	1.6	0 (0.0%)	0.6

Note: An asterisk (*) indicates the average scores for the baseline and endline EGRSLA were statistically significantly different at $p<0.05$.

The average score for the MSL vocabulary subtask was significantly higher at endline in both grade 1 and grade 2. At endline, grade 1 students correctly matched 7.3 MSL signs out of a maximum of ten signs—an increase of 0.8 signs from the baseline average. Grade 2 students, on average, correctly matched 8.1 MSL signs out of a maximum of ten signs at endline—an increase of 0.6 signs above the baseline average. All students matched at least one MSL sign with its corresponding image at baseline and endline.

Results by Gender and School

Gender

Results for the 49 girls and 84 boys in the sample were disaggregated to determine whether there were differences by gender in students' performance at endline. The sample included 133 students; 49 girls (36.8 percent of the total sample), with 19 girls in grade 1 and 30 girls in grade 2; and 84 boys (63.2 percent of the total sample), with 43 boys in grade 1 and 41 boys in grade 2. Because all students enrolled in grade 1 and 2 in intervention schools were assessed, the gender imbalance in the sample is due to different levels of enrollment for girls and boys.[83]

Figures 6 and 7 presents EGRSLA results by gender at endline for grade 1 and grade 2 students, respectively. **Differences in girls' and boys' performance were found to be statistically significant at endline on the reading passage subtask. On that subtask, among grade 1 students, girls' average fluency was 12.5 CWP2M compared with 2.8 CWP2M for boys.** There were no statistically significant differences between grade 2 girls' and boys' performance at endline.

83 The sample was not stratified by gender, as the project research questions did not specifically seek to explore performance between girls and boys. Sample sizes of girls and boys by grade should be taken into consideration upon review of results.

Figure 6: **EGRSLA and MSL Vocabulary Assessment Mean Scores by Gender and Timepoint — Grade 1**

Note: Grade 1 Girls *n* = 19; Grade 1 Boys *n* = 43. An asterisk (*) indicates the average endline EGRSLA scores for boys and girls were statistically significantly different at p<0.05.

Figure 7: **EGRSLA and MSL Vocabulary Assessment Mean Scores by Gender at Endline — Grade 2**

Note: Grade 2 Girls *n* = 30; Grade 2 Boys *n* = 41.

The percentage of students receiving zero scores by grade and gender at endline is presented in Table 14.[84] **In grade 1, there was a statistically significant difference in the proportion of boys and girls receiving zero scores at endline on the reading passage and reading passage comprehension subtasks.** A significantly higher proportion of boys received zero scores than did girls on the reading passage subtask—79.1 percent compared to 52.6 percent—and on the reading passage comprehension subtask—90.7 percent compared to 68.4 percent. **There was no statistically significant difference between the proportion of grade 2 boys and girls receiving zero scores at endline.**

Table 14: **Percentage of Students Receiving Zero Scores by Grade and Gender at Endline**

Subtask	Grade 1		Grade 2	
	Girls (*n* = 19)	Boys (*n* = 43)	Girls (*n* = 30)	Boys (*n* = 41)
Letter Name Identification	1 (5.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Syllable Identification	1 (5.3%)	1 (2.3%)	0 (0.0%)	0 (0.0%)
Familiar Word Reading	8 (42.1%)	17 (39.5%)	7 (23.3%)	10 (24.4%)
Reading Passage^	10 (52.6%)	34 (79.1%)	13 (43.3%)	23 (56.1%)
Reading Passage Comprehension^	13 (68.4%)	39 (90.7%)	20 (66.7%)	31 (75.6%)
MSL Comprehension	15 (78.9%)	37 (86.0%)	21 (70.0%)	30 (73.2%)
MSL Vocabulary	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Note: A caret (^) indicates the percentage of boys and girls receiving zero scores was statistically significantly different at $p<0.05$ for only grade 1.

School Results[85]

The intervention schools were notably diverse, with different enrollments, teaching structures, resources, and teaching pedagogies related to use of MSL versus oral language. To better understand how this heterogeneity may have impacted student reading and MSL skills, EGRSLA results at baseline and endline are disaggregated by school for grade 1 and grade 2 students and presented below. Descriptive statistics on two illustrative subtasks—letter name identification and familiar word reading—are shown; results for the remaining subtasks are presented in Annex Table D.3 and D.4.[86]

Letter name identification results for grade 1 and grade 2 students are presented in Figures 8 and 9, respectively. The average letter name identification fluency for grade 1 students increased over time across schools from 56.7 CLNP2M at baseline to 69.3 CLNP2M at endline. At endline, the average fluency rate for grade 1 students by school ranged from 26.3 CLNP2M in the lowest performing school to 99.3 CLNP2M in the highest performing school. The average letter name identification fluency for grade 2 students increased over time across schools from 79.3 CLNP2M at baseline to 87.9 CLNP2M at endline. In three schools, letter name identification fluency decreased from baseline to endline. At endline, the lowest average letter name identification fluency rate by school for grade 2 students was 56.2 CLNP2M, and the highest was 121.9 CLNP2M.

84 The differences between the percentage of boys and girls receiving zero scores at endline were tested for statistical significance using the chi-square test.

85 Sample sizes by school are not provided to maintain confidentiality.

86 Inferential statistics were not computed due to small sample sizes in some schools.

Figure 8: **Mean Letter Name Identification Fluency (CLNP2M) by School and Timepoint — Grade 1**

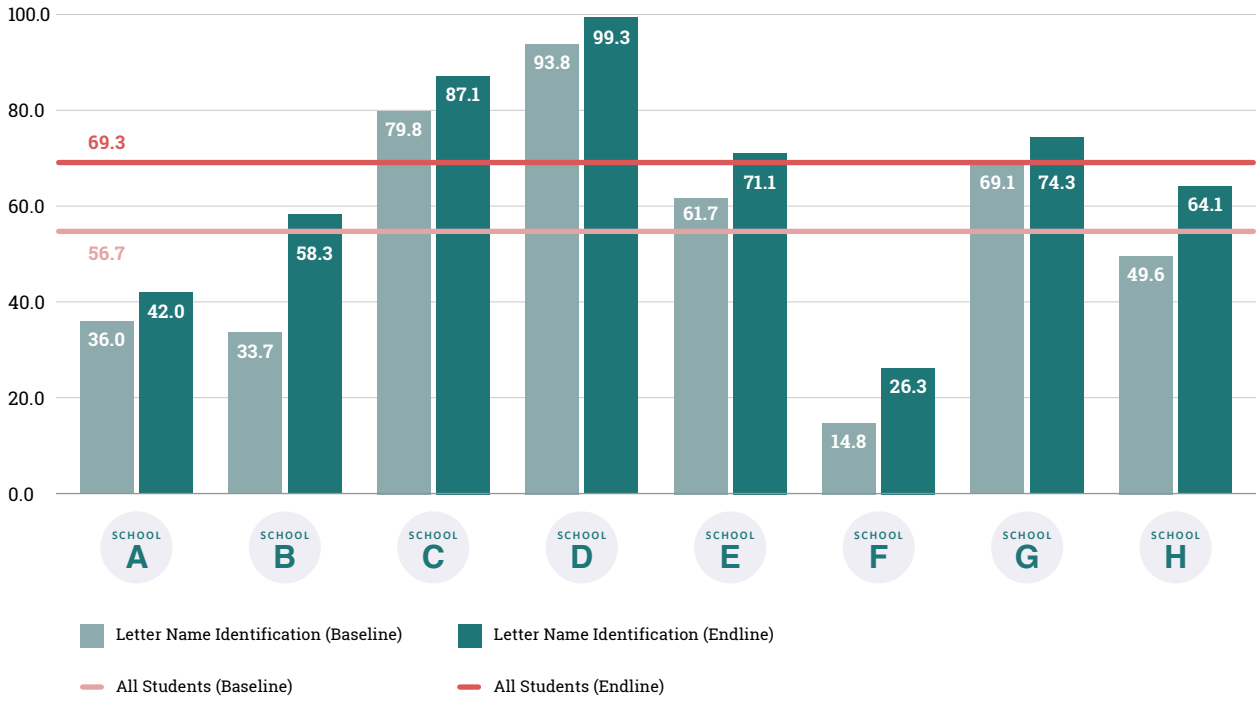
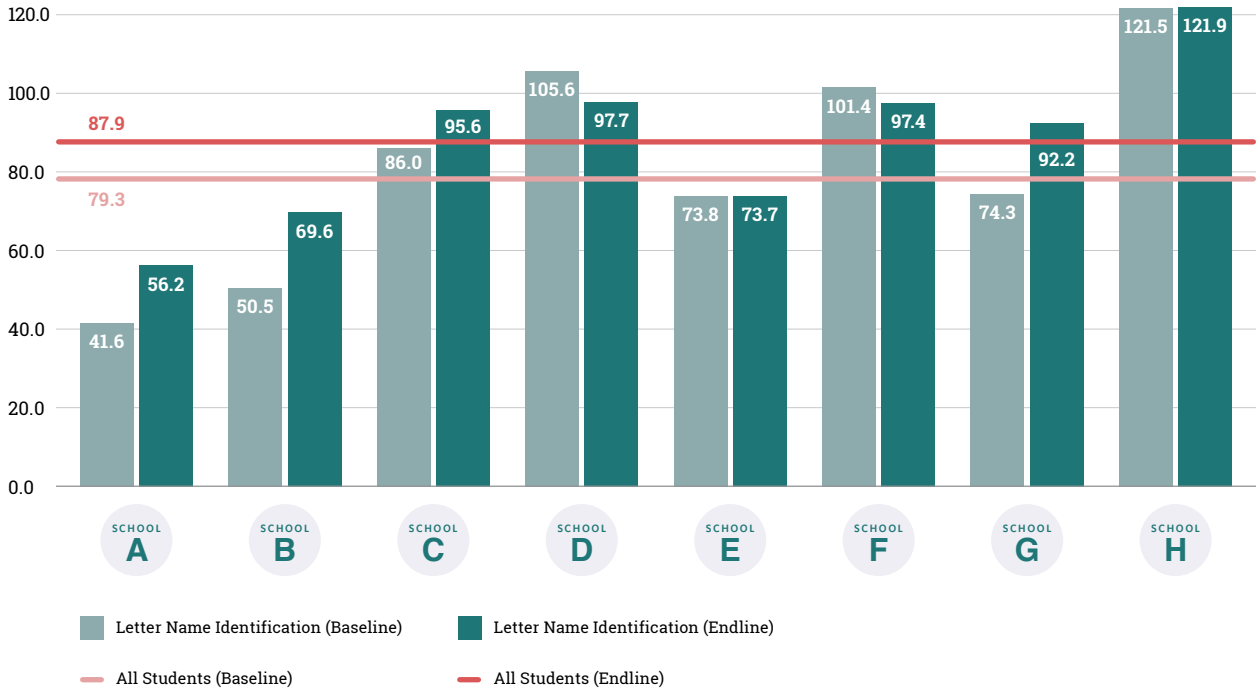


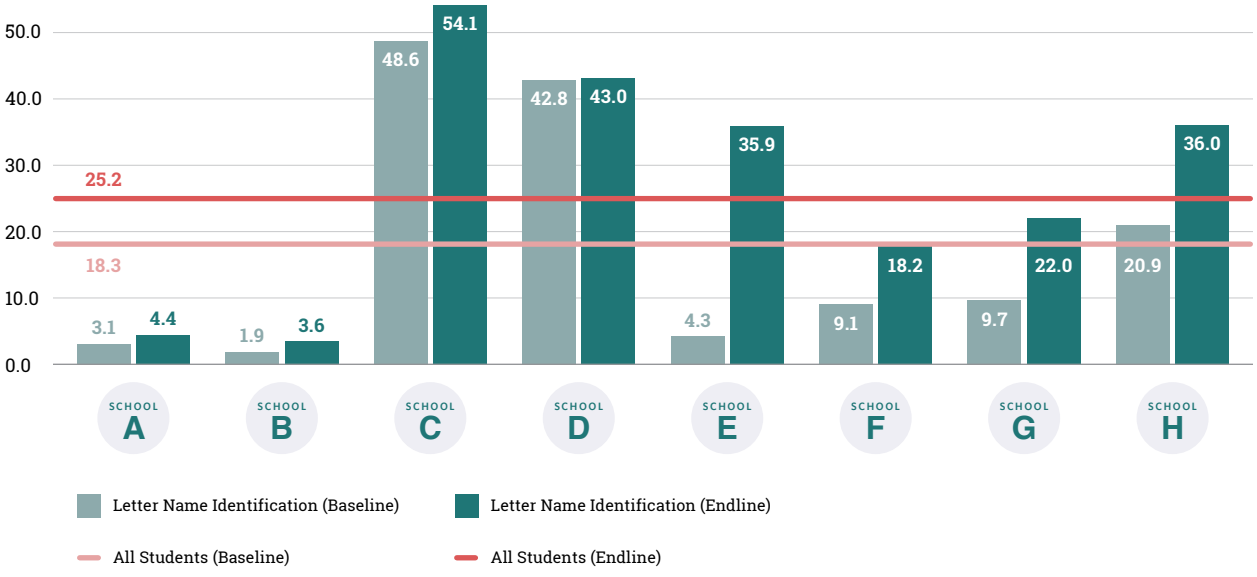
Figure 9: **Mean Letter Name Identification Fluency (CLNP2M) by School and Timepoint — Grade 2**



Performance similarly varied across schools on the familiar word reading subtask as shown in Figures 10 and 11 for grade 1 and grade 2 students, respectively. In one school, grade 1 students' average fluency rate on the familiar word reading subtask remained at 0.0 CFWP2M across baseline and endline, while the highest average fluency rate by school at endline was 38.1 CFWP2M. In one school, the average fluency rate for grade 1 students decreased over time; all other schools increased their rates or remained the same. For grade 2 students, the average familiar word reading fluency rates by school at endline ranged from 3.6 CFWP2M to 54.1 CFWP2M. The average fluency rates for grade 2 students on this subtask increased over time for all schools.

Figure 10: **Mean Familiar Word Reading Fluency (CFWP2M) by School and Timepoint — Grade 1**

Figure 11: **Mean Familiar Word Reading Fluency (CFWP2M) by School and Timepoint — Grade 2**



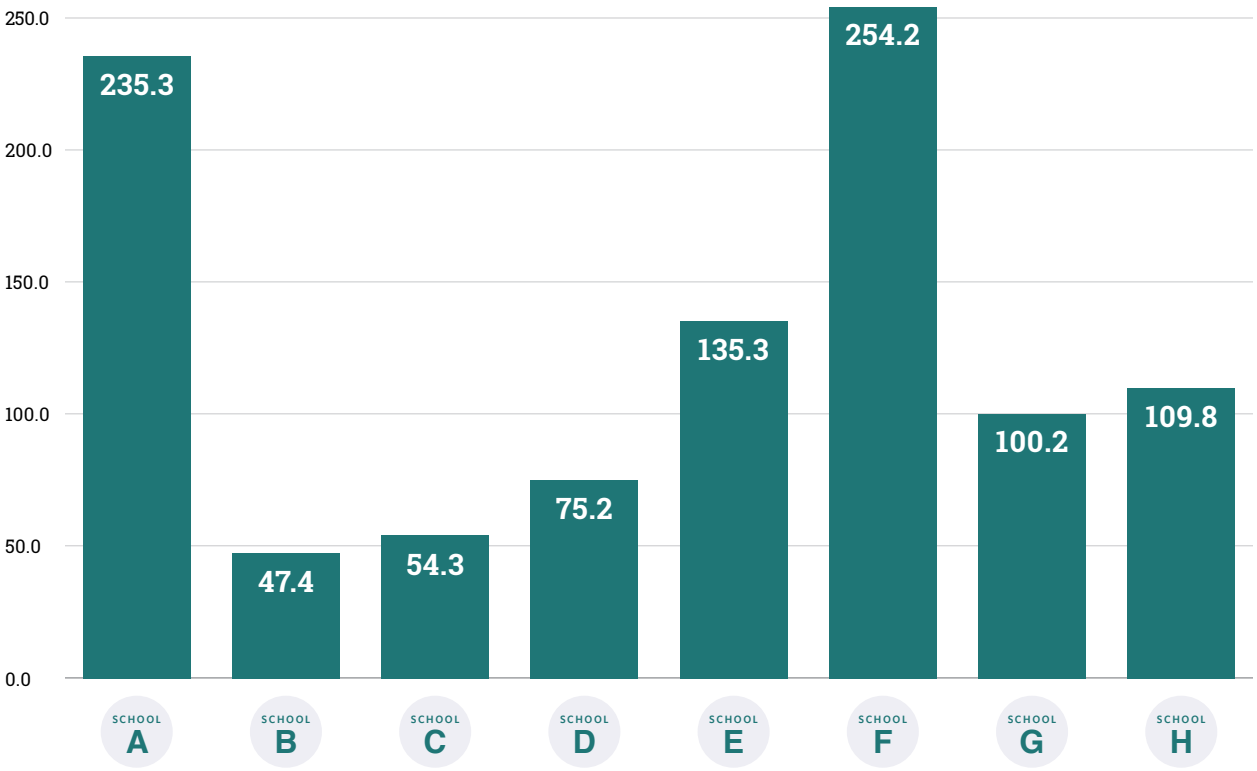
Additional Findings

Software Usage by School

IDRT collected monthly monitoring forms from teachers to track the prevalence of software usage and to understand which parts of the *MSL Clip and Create* software were most utilized. A summary of this data collected between October 2017 and March 2018, is presented in Figure 12, which illustrates the difference in students' exposure to the software. Because some teachers failed to submit forms for every month, the results show the average usage by the school over six months.

As evidenced in Figure 12, the frequency of software usage varied widely across schools. Some schools—namely schools A and F—used *MSL Clip and Create* more than four times as often as schools B and C over the six-month period.

Figure 12: **Mean Counts of Software Usage by School**[87]



Note: Number of monitoring forms submitted by school: School A = 8; School B = 12; School C = 12; School D = 5; School E = 6; School F = 5; School G = 11; School H = 12.

87 Software usage is comprised of five categories of activities, each of which are counted differently. Dictionary use counts the average number of times per month that teachers in a school looked up a word or searched for a word based on its sign in *MSL Clip and Create*. Publisher and materials production shows the average number of materials produced per month by teachers and includes the production of crossword puzzles, word searches, SIGN-O cards, matching games, flashcards, fingerspelling scrambles, and other printed materials. Sharing of materials counts the average number of times per month materials were shared. Student software use is the average number of times teachers have given students access to the software to use the dictionary, publisher function, or print. Lastly, story indicates the average number of times per month a teacher used the "see the story" function of the software.

IX. Project Implementation Findings

This section explores the research question, *how did the project influence or impact adults'—teachers, parents, and community members—knowledge, skills or attitudes regarding children's ability to learn to read and sign?* This section also examines the specific perceptions of key stakeholders and beneficiaries regarding the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project. These questions were answered through qualitative and semi-structured EOP interviews, as well as an endline questionnaire administered to 13 teachers from eight intervention schools.[88]

MSL Clip and Create Software

In general, users of the *MSL Clip and Create* software reported favorable opinions of the software. No teachers or teachers' aides expressed challenges in learning to use the software, indicating that the project provided sufficient training on the use of the software. Of the 13 teachers who responded to the endline questionnaire, 11 said that they used the dictionary or thesaurus portion of the software to teach their students MSL. Six of these teachers said that, on average, they used this function every day; the five remaining teachers reported that they used it two to four times per week. In qualitative interviews, many teachers and teachers' aides noted that they most often used the software to look up vocabulary. Nevertheless, a majority of teachers stated that the software did not have all the vocabulary needed to teach the MNE curriculum. Several teachers said they would like the software to include vocabulary for subjects such as science, mathematics, and history, as well as more complex content, like full sentences. Teachers also mentioned that the MSL they used in their school was not fully represented in the software, specifically in the first version of *MSL Clip and Create*. Respondents expressed concerns that the selection of words and clip art images included in the software were culturally inappropriate, biased, and not streamlined with the standard curriculum. Further, when teachers were asked what they do when they cannot find the sign they want in the software, many said they referenced sign language from other countries, such as Belgium, France, or Qatar through mobile applications or websites.

Teachers also used the publisher function of the software to develop and print materials, although with less frequency than they used the dictionary or thesaurus functions. Of the ten teachers who said they used the publisher in the questionnaire, one used it every day, seven said they used it between two and four times per week, and two said they used it once or less a week. Teachers most often used the publisher function to create worksheets, flashcards, and posters (Annex E.5).

MSL Clip and Create main menu

MSL Clip and Create dictionary entry for the word "rabbit"

MSL Clip and Create fingerspelling scramble

88 Only official classroom teachers responded; teachers' aides did not respond to the endline questionnaire.

MSL Clip and Create dictionary entry for the word "year"

During qualitative interviews, one teacher noted that, compared with her previous method of drawing by hand, the software offered a more efficient way to design learning materials.

Most of the teachers interviewed did not report using the software at home, because they either did not have a computer or did not have the software installed on their computer. Several of the teachers noted that they would like to have the ability to use the software outside of school to prepare their lessons before or after class or on the weekends. In fact, the one teacher interviewed who did have the software on a home computer expressed that it was helpful for lesson preparation.

When asked, most teachers said they would continue to use the software in the future, although they expressed a need for more vocabulary, more complex content, and better representation of regional variations. All teachers interviewed had a smartphone, and many said they would find it beneficial to have access to the dictionary or thesaurus through a smartphone application, rather than exclusively on a desktop computer.

Of the twelve family members interviewed, only two said that they had heard of the software through their children and none of them had seen or used it.

Reading Instruction Trainings

Teachers were very enthusiastic about the knowledge gained through the trainings, and they listed a variety of takeaways during the interviews. Several teachers described their change in perception of the abilities of people who are deaf both because of the content provided in the trainings and by having experts who are deaf lead the trainings. One teacher said she wanted to learn more about how the trainers who are deaf had reached their level of success, as she wants her students to have similar opportunities.

Further, teachers in two schools expressed the importance of having educators who are deaf in leadership roles within schools. One teacher said that they learned from the trainings about the importance of having people who are deaf or hard of hearing create learning content; other teachers in the same school noted that now they more actively involve their fellow teachers who are deaf in their classrooms. Teachers described a difference in students' engagement when taught by a teacher who is deaf. In another school, teachers and teachers' aides both described the increased role of the aides who are deaf in classroom instruction. Several teachers noted their new appreciation for team teaching, especially with adults who are deaf.

In interviews, teachers also discussed their new awareness of how to use MSL and oral language in their classrooms. Several said they had learned about the importance of using one language at a time and not simultaneously signing and talking to the students. Several described how the project's trainings had taught them how to develop an entire lesson in MSL from a single vocabulary word in the software. Asked on the endline questionnaire whether they believe their students should communicate using MSL, ten of 13 teachers strongly agreed and three of 13 agreed. Last, when asked if they believe that they should teach using MSL instead of using oral language, only three of 13 teachers disagreed, while ten of 13 agreed or strongly agreed. It should be noted that no pre-intervention interviews were conducted, so it is unclear to what extent changes in attitude can be attributed to the project.

Interviewed teachers also said they learned about setting up the classroom in a U-shape, different ways to employ differentiated instruction in the classroom, and how to tell stories in a more expressive manner. One teacher mentioned that, by using the stories in the software and having her students sign the stories in front of the class,

she realized that her students—even the shy ones—had skills in storytelling and acting. Furthermore, teachers now appear to have an awareness of the learning capacities of their students. Specifically, when asked on the endline questionnaire if they believe their students can learn to read, eight out of the 13 teachers strongly agreed, five agreed, and none disagreed.

Although teachers had positive feedback regarding the trainings, school directors and stakeholders had constructive critiques of the topics addressed during the trainings, the selection of teachers who attended the trainings, and the level of coordination with MNE on the trainings. During interviews with the project's staff, USAID stakeholders, and MNE, it was evident that the selection of training topics was not developed in consultation with MNE nor was it based on a formal needs assessment of the teachers' skills; rather, the content was determined by feedback from USAID respondents, select schools, and project staff.

This absence of a systematically developed training curriculum for teachers was particularly pronounced given the different levels of training, teaching experience, and MSL fluency of the intervention school teachers. When asked what other types of training topics they would have liked to receive from the project, several teachers and school directors expressed a need to have more in-depth training on MSL, specifically to improve language fluency and knowledge of grammatical rules. Teachers from three different schools said that they wanted more knowledge of the linguistic structure of MSL. One said that their lack of academic training in MSL means that they sign using the linguistic rules of Arabic instead of MSL, which she believed impedes her students' ability to understand her. A school director from a different school expressed a similar sentiment, noting that they sign following the grammatical rules of Arabic rather than following the structure of MSL.

Other teachers requested more practical trainings focused on lesson demonstrations to facilitate teaching subjects other than Arabic, such as science or history. Another teacher said she would like to have better knowledge of how to serve the needs and engage students with multiple disabilities. Further, one school director expressed that, although the pedagogical trainings appeared to be beneficial to the teachers, the lack of preservice training and specialization available to teachers puts them at a disadvantage; as a result, it limited their ability to maximize the information provided.

Not all grade 1 and 2 teachers attended all the trainings, either because they were not able to or because their school sent teachers' aides or teachers from different levels instead. It was unclear how schools prioritized who was selected to attend trainings and to what extent schools encouraged knowledge sharing amongst teachers who attended and those who did not.

Steering Committee

Opinions on the efficacy of the steering committee were mixed. In interviews, USAID respondents said that the greatest successes of the steering committee were the dialogues instigated between relevant ministries and Deaf education stakeholders and the mobilization of civil society in an organized group. IDRT project management also recognized that Deaf association and steering committee members had increased pressure on the Moroccan government to support Deaf education in the country. One steering committee member stated that the main benefit of the committee was to create and strengthen linkages between the different Deaf associations through meetings and exchange visits.

However, other committee members noted challenges with the structure and efficacy of the committee. Two interviewees expressed issues with committee members' competing visions of Deaf education, lack of consensus over the best approaches to improve Deaf education, and lack of representation of people who are deaf on the

committee. One member expressed frustrations over the lack of response from the government to the steering committee's letters with formal requests and questioned the ability of the steering committee to make a change. This interviewee noted that unionizing would increase the leverage of the committee with ministries.

Sustainability of the Project

There is considerable interest in and opinion about what components of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project are sustainable. When asked, teachers said they would continue to use the software. Many also expressed a desire for additional technical training, specifically on the practical application of teaching techniques to support students who are deaf or hard of hearing. Given this feedback, it seems that teachers will likely continue to use the software from the project as a supportive tool for their teaching, although it will not be a critical part of their teaching practice—particularly because of the limited amount of vocabulary or depth of subject content included in the software.

USAID representatives expressed concerns over the sustainability of the software in schools. Because the *MSL Clip and Create* software is proprietary and cannot be modified or updated without a skilled technical team, and due to the limited amount of words included, USAID respondents noted their doubts about whether the software will continue to be useful and impactful for teachers and students in project schools. They expressed a desire for future projects to build the capacity of the local government to develop and manage technology to support students who are deaf or hard of hearing and their teachers.

Based on feedback from steering committee members and USAID representatives, it appears that the most sustainable parts of the project are the relationships and connections formed between the different actors involved in Deaf education in Morocco. Members of the steering committee noted the impact of the exchange visits between schools as a way to share experiences and think about how to improve education, and several expressed the expectation that, by unionizing, they would be able to better lobby the government to support their needs. USAID also cited the dialogue generated between these actors as the main success of the project.

Despite this, the MNE representative did not appear to be satisfied with the coordination between themselves, the project, and USAID. Specifically, the MNE respondent said that MNE and MDSFS were not adequately consulted on the selection of schools, technical activities, and training locations. He noted that integrated classroom teachers from the government were not invited to participate and that a more sustainable approach would have been to have Deaf associations participating in the project train other associations in their area. It is unclear if these opinions are held by other key stakeholders from MNE or MDSFS, although it is likely that the future sustainability of the project is highly dependent on government buy-in.

X. Additional Findings

There were many additional issues that emerged during interviews and through questionnaires that were not directly related to the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project but are particularly relevant to the future of Deaf education in Morocco. Findings are grouped into four themes: attitudes about people who are deaf or hard of hearing, teacher training and certification, the role of the government in Deaf education, and parents' skills and engagement. These four themes are expanded on in this section to more comprehensively demonstrate—to funders, implementers, and educators—the range of existing challenges and priorities of stakeholders working in Deaf education.

Attitudes about People who are Deaf or Hard of Hearing

Interviewees consistently mentioned dissatisfaction with preexisting negative attitudes about people who are deaf. Two school directors discussed the lack of human rights afforded to people who are deaf or hard of hearing at all levels of society in Morocco. More specifically, one school director stated that the Moroccan government needs to recognize people who are deaf or hard of hearing as equal and legitimate citizens and recognize their rights to education and health. Another school director shared the perception that, even in countries with lower levels of development, people who are deaf or hard of hearing have greater access to education than in Morocco.

Two mothers and one teacher, all of whom are deaf, mentioned that people who are deaf or hard of hearing should not be marginalized. One mother noted that there should be improved recognition of people who are deaf or hard of hearing, and another teacher said there should be recognition by the government that people who are deaf do exist and have rights. Moreover, two USAID representatives discussed the existing negative attitudes about the capacity of people who are deaf or hard of hearing in Morocco. Both articulated the need for greater empowerment of people who are deaf or hard of hearing within Moroccan society to create effective change. For this to happen, said one interviewee, there needs to be more access to quality education so that people who are deaf or hard of hearing can take up leadership roles. Several teachers and at least one parent added that the lack of sign language interpreters in public spaces was a major concern.

Parents also shared a range of opinions regarding their children's abilities. Those who had both children who are deaf or hard of hearing and children who are hearing acknowledged the differences in the rigor of schooling and in future opportunities for their children. It was unclear, however, to what extent parents believed this was a function of the inherent ability—or, in their opinion, inability—of their children to learn and succeed or a function of unequal access to schooling and opportunities. With limited support provided to parents or caretakers, it is unlikely that the project impacted their knowledge or attitudes about the abilities of their children who are deaf.[89]

Teacher Training and Certification

Conversations with school directors and responses from teachers highlighted the lack of formal, standardized training for educators of students who are deaf or hard of hearing. According to the questionnaire administered to teachers at baseline, all teachers reported receiving training on teaching students who are deaf or hard of hearing, but only one had a formal certificate in teaching from a government institution.[90]

School directors and stakeholders from USAID and MNE expressed that the lack of formal training of Deaf education teachers is a major area for improvement within Morocco. One school director and one steering committee member called attention to the weak teaching skills of teachers, citing that as a key reason that

89 The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project intends to provide direct training and support to parents before the end of the grant, although none of these supports had been delivered by publication of this report.

90 A teacher from a non-research school also had formalized government training.

students struggle and that teachers were unable to maximize the technology provided by the project. This school director suggested there should be a centralized training center or preservice teachers' college for individuals who want to become teachers of students who are deaf. The MNE representative interviewed stated that teachers who are appointed to instruct students who are deaf or hard of hearing in government schools participate in limited training on Deaf education and receive supplemental, but irregular, trainings from NGOs. He also noted that he is not satisfied with the current approach to provide trainings to these teachers, and he suggested training centers for preservice teachers as a necessity.

In addition to the need for additional training, one teacher suggested that there could be increased national-level awareness of MSL as a language through media campaigns or publications. A school director suggested that individuals from Morocco could study at universities outside of the country to learn about the linguistics of sign language and apply those learnings to MSL. Interviewees frequently mentioned challenges related to the lack of documentation, standardization, or linguistic understanding of MSL, especially for those working in Deaf education.

USAID representatives provided similar feedback on the need for more formalized training for teachers working in Deaf education. One USAID official interviewed cited the lack of teacher training in inclusive education as one of the key issues facing students with disabilities in Morocco. Both USAID/Morocco officials interviewed mentioned that a focus on pre- and in-service teacher training should be immediate priorities for Deaf education in Morocco.

Role of the Government in Deaf Education

One of the most frequently cited challenges and dissatisfactions among individuals interviewed was the role of the government in Deaf education. Most children who are deaf in Morocco receive their education through privately run, segregated educational centers, which provide primary grade schooling and, in few cases, schooling beyond grade 6. Although feedback from school directors and teachers indicated unanimous agreement that the government should play a larger role in Deaf education, there was notable disagreement on what that support should look like.

When asked what the priority of the government or international donors should be, teachers from five schools said creating or adapting a curriculum for students who are deaf or hard of hearing. Some teachers suggested that an entirely new curriculum should be created, while others suggested that the existing curriculum be adapted for students who are deaf or hard of hearing. One teacher proposed including content on MSL in the national curriculum to raise awareness and knowledge of MSL as a language.

Another key priority cited by school directors and teachers was greater governmental involvement in the primary school education of students who are deaf or hard of hearing. Although several school directors and at least one teacher mentioned that the government should fully take over primary education for students who are deaf or hard of hearing, others expressed doubts about the capacity of the government to provide quality education to these students. Two school directors suggested that if the government did take over the education of students who are deaf, the Deaf associations could provide support in the form of social services, extracurricular activities, and supplementary education, in addition to the continual training of government teachers. The two USAID representatives expressed the need for more government involvement at the primary level for students who are deaf or hard of hearing, although both envisioned that Deaf associations would continue to have a significant role in these students' education.

Another frequently cited issue was the lack of MSL consistency across Morocco, resulting in significant regional variations in Deaf education. Although this was mentioned in several different schools, teachers in two schools explicitly expressed a need for unification and documentation of MSL from the different regions of the country. A representative from the MNE said that standardizing MSL was a priority of the ministry.

Across all respondents, there was unanimous agreement that there should be more access to educational opportunities before and after primary school for students who are deaf or hard of hearing. Others expressed challenges with the mainstreaming of students in middle school due to limited or no access to interpretation for these students. Some of the Deaf association schools currently provide educational opportunities—vocational or academic—for students beyond grade 6; one school has just begun to mainstream students in a middle school with trained interpreters. Nevertheless, these opportunities are not equal across schools or regions. One teacher expressed the need for preschool education, and many teachers, school directors, and parents mentioned the need for students who are deaf to access middle and high school education. A Deaf association president stated that his dream was to see people who are deaf or hard of hearing in Morocco graduate from university. Parents, in particular, expressed a desire to have better vocational opportunities for their children.

Parents' Skills and Engagement

Although some Deaf associations have outreach activities, there are gaps in most family members' ability to communicate in MSL and in parents' engagement levels with their children's school. On the endline questionnaire, eight teachers responded that their school engages parents or caretakers in students' learning. In interviews, several teachers mentioned that their schools offer MSL classes for family members or attempt to engage parents when they pick up their children from the school.

Despite this, qualitative responses from teachers indicate that the level of engagement of parents is not satisfactory. Two teachers identified the distance between students' homes and the school as an impediment to parent engagement. Nearly all teachers cited a lack of understanding, preexisting biases about deafness, and a lack of MSL abilities as the primary reasons that parents do not engage more with the schools. One teacher commented that some of the parents at her school appear to think that children who are deaf are less important than children who are hearing. Another teacher, who said that existing perceptions about the abilities of children who are deaf make parents less willing to help, suggested that government-sponsored sensitivity campaigns could raise awareness and change perceptions. A different teacher noted that, for students with parents who are hearing, their lack of knowledge of MSL and understanding of the capacities of their children means they cannot support their children at home. Specifically, she discussed that these parents think their children's ability to write a word in Arabic is enough because they do not expect much. Others said that, when MSL classes are provided, very few parents attend.

Parents were also asked about the different ways that they communicate with their children and about their fluency in MSL. Although most parents said they have no trouble communicating with their children, most—specifically those who are hearing—did not communicate with their children predominantly through MSL. Two parents said that they rely on their child's limited hearing or lip reading to communicate, while others said they use a mix of MSL and invented signs. Some parents appeared more dedicated than others to learning MSL, whether by accompanying their children to school, taking classes, or by having their children teach them signs at home. Three parents identified as fluent in MSL—two of whom are deaf and one whom is hearing.

When parents were asked whether they meet with their children's teachers, most answered that they do so every once in a while, while a few said they come every day. One mother said her child no longer allows his parents to come to the school because he is too old to have his parents checking in with his teachers. Three parents said they go to the school to learn MSL, either through classes or by learning along with their children during the school day. The other interviewed parents said they did not attend the classes offered by the school or that the school did not offer classes.

XI. Conclusion

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project introduced an assistive technology—*MSL Clip and Create* software—in ten schools throughout Morocco. Through the project, IDRT also delivered trainings to teachers, school directors, and key stakeholders of Deaf associations in Morocco, as well as support for the creation of a steering committee to engage decision makers in discussing the needs in Deaf education. Begun in October 2015 and scheduled to end in October 2018, the project aims to improve the reading skills of students who are deaf or hard of hearing in Morocco.

Teachers had positive feedback regarding the trainings provided by the project, and most said they would continue to use the software in the future. Although it is not possible to deduce the impact of the project on students' reading and MSL skills because of research limitations, results from the EGRSLA and MSL vocabulary assessment indicate that students' skills are improving over time. However, these improvements are uneven across schools, and results on the reading passage, reading passage comprehension, and MSL comprehension subtask point to fundamental challenges in full sentence reading and comprehension in both MSA and MSL among early grade students. Despite the positive impressions of many stakeholders about the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project, quantitative and qualitative findings indicate that the project design did not adequately address the most immediate literacy and MSL needs of students, or the instructional needs of their teachers.

There are, however, fundamental systemic issues confronting students who are deaf or hard of hearing and their educators. Although these challenges were outside the scope of the project, they constrained the project's ability to influence students' reading and MSL skills development. Morocco is constitutionally bound to fight discrimination based on disabilities. It signed on to the UNCRPD and adopted a disability law in 2016 articulating that people with disabilities have the right to education. However, most students who are deaf or hard of hearing are educated in segregated education centers that are privately managed with no governmental oversight. Teachers at these education centers are not sufficiently trained in special education or fluent in MSL, further exacerbating the educational challenges faced by students. There are limited options for students who are deaf or hard of hearing to attend preschool or secondary school, and access to vocational training is uneven. Even for those children who do learn MSL, the public's lack of capacity to communicate with individuals who are deaf or hard of hearing and the dearth of MSL interpreters to address this gap in communication limit opportunities for integration and inclusion into Moroccan society. Given the complex and comprehensive challenges surrounding Deaf education and the lack of equal rights for people who are deaf or hard of hearing in Morocco, it is improbable that a small-scale technology-focused intervention will have the ability to make sustainable and broad-based impacts on the system-wide challenges impacting the reading abilities of students who are deaf or hard of hearing.

Regardless, there are several critical lessons learned through the implementation of the Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project that can inform donors interested in funding projects for students who are deaf or hard of hearing, as well as other stakeholders interested in improving Deaf education in Morocco more broadly.

Lessons Learned

Projects supporting children who are deaf or hard of hearing should include components of parental engagement, especially in contexts where deafness is poorly understood and sign language is underutilized.

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project targeted teachers who contribute to student learning once a student enters the education system. However, parental engagement is a key contributor to children's learning, especially for children who are deaf or hard of hearing with little access to language early in life. Based on responses from students and parents, it is evident that many children who are deaf or hard of hearing in Morocco are language-deprived in their early years. To fundamentally improve the reading of students who are deaf or hard of hearing, these students must have greater access to sign language outside the school system. Projects working in Morocco or in similar contexts should strongly consider assessing family members' knowledge and awareness of deafness and sign language prior to implementing and designing components of their intervention to inform the inclusion of appropriate interventions and activities that would bolster parent engagement and abilities in sign language.

Projects that support people who have disabilities should, as much as possible, engage experts with disabilities to design, lead, and participate in the work.

In Morocco, people who are deaf or hard of hearing are marginalized, especially in the education system. The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project trained and employed a deaf artist, a deaf videographer, one hard of hearing and three deaf native sign informers, and one deaf assessor. However, people who are deaf or hard of hearing were not in leadership positions in the project nor members of the steering committee, and a disproportionately greater number of teachers at intervention schools are hearing than are deaf or hard of hearing. Perhaps because of this, project beneficiaries were notably impacted by the presence of international experts who are deaf or hard of hearing as training leaders and technical advisors. Students and their teachers had not been exposed to highly educated professionals who are deaf or hard of hearing prior to the project because of the lack of opportunities for Moroccans who are deaf or hard of hearing. The ability to see this type of success was transformative for many of the beneficiaries, who expressed their change in beliefs about people with disabilities as a result of meeting these individuals. Furthermore, the inclusion of assessors who are deaf or hard of hearing afforded legitimacy to the research conducted for the project. Projects should be fully dedicated to enfranchising and empowering people with disabilities in project leadership; additionally, they should implement and encourage this type of inclusion systematically throughout the society in which they are working.

Assistive technologies have the potential to provide support to teachers, especially in contexts where there is little access to teaching resources.

Prior to the introduction of the *MSL Clip and Create* software, teachers working in Deaf education in Morocco had little access to technology or supportive resources. Despite some of the challenges expressed by teachers and school directors over the type or amount of vocabulary accessible in the software, all teachers recognized the benefits of having access to an assistive technology to help teach their students MSL and MSA. Several noted the

time savings experienced as a result of having the software, and all expressed a desire to have a mobile-friendly version of the software. Despite these positives, software usage across schools varied widely. When developing software, projects should carefully consider the prevalence of certain types of hardware within a specific context—such as desktop or laptop computers, tablets, and smartphones—and design a product that can be accessible to a wide audience. Projects should also take into account local capabilities with technology and ensure that software can be continuously improved and expanded in a sustainable manner.

Systematic and cross-sectoral needs assessments should be conducted prior to a project's implementation to determine training and technological priorities of the beneficiary population.

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project was designed to deliver an MSL assistive technology. Over time, the project added a teacher training component to help build the capacity of educators working in intervention schools. No formal and systematic needs assessment was conducted with the project schools nor the government ministries supporting Deaf education. As a result, the project did not introduce training topics to teachers based on an established curriculum developed to target their diverse needs. Further, the project did not appear to be synchronized with the initiatives being promoted by the Moroccan government; this led to activities that seemed out-of-step with governmental priorities. Specifically related to the *MSL Clip and Create* software, IDRT was not instructed to create a software that could be owned and managed by the Moroccan government after the end of the project. Stakeholders and implementers should coordinate at the design stage of projects to systematically assess the needs of beneficiary populations and the capacities of local counterparts responsible for the sustainability of project activities and impacts.

Projects focused on supporting under- or undocumented languages should ensure inclusion of all relevant stakeholders and language-users in the documentation process, especially when supporting marginalized or disenfranchised populations.

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project confronted language documentation issues and successfully resolved a portion of them. At the beginning of the project, comprehensive documentation of MSL or research on MSL syntax did not exist. Additionally, the substantial amount of regional variation became clear to project staff and STS only after the release of the first version of the software and the pilot test of the EGRSLA. The second version of the software incorporated regional variations into the dictionary, and teachers noted that this also helped them learn signs from other parts of the country. Additionally, the EGRSLA instrument and protocols were updated to better reflect regional variations. This valuable language documentation process did, however, have unintended negative consequences. Buy-in from stakeholders and beneficiaries whose regional signs were not initially incorporated in the software and EGRSLA was more difficult to garner, as they felt disenfranchised and unrepresented. Further, the selection of words and clip art images included in the software were, according to some beneficiaries, culturally inappropriate or biased. Future projects that support the documentation and exploration of under- or undocumented languages should be highly intentional in ensuring the inclusion of those language-users at the start of the project. It is also critical to clearly communicate that documenting a language and all its variations is an ongoing process that benefits from broad and ongoing contributions.

Coordination and communication across key stakeholders should be prioritized to create sustainable and targeted interventions to support beneficiaries.

The Moroccan Sign Language Assistive Technology for Reading Improvement of Children who are Deaf/Hard of Hearing project supported the creation of a steering committee with members from Deaf associations across the project's intervention schools. Although not all members were satisfied with the efficacy of the committee, most valued the increased dialogue and sharing of experiences that the committee fostered. This sentiment was echoed by USAID representatives, who stated that the dialogue between the Deaf associations and the Moroccan government was the greatest success of the project. Nevertheless, according to the MNE representative interviewed, the project did not sufficiently coordinate its activities—specifically its trainings—with ongoing ministry activities and strategies in Deaf education. This lack of strategic coordination may have impeded the ability for learnings to be more comprehensively shared across those working in Deaf education. Projects should make efforts to engage, communicate, and coordinate with key stakeholders in the government to ensure buy-in and sustainability of activities, and to align projects with ongoing initiatives to maximize impacts.

Annexes

XII. Annexes

Annex A: **EGRSLA Instruments**

01 Endline 2018 Part 1

Letter Name Identification, Syllable Identification, Familiar Word Reading, Reading Passage, Reading Passage Comprehension

Enumerator Name	

Date and Time

Date	
Time	

School

School Name	
School Name (English)	
Student Name	
Student ID	

Student Name Verification

Is this [Student Name]?

☐ لا ☐ نعم

Transition Comment

Random ID

Random ID	

Consent

السلام عليكم، اسمي .....، أسكن في .....، لدي أطفال يحبون .....، وأنت ماذا تحب(ين)؟

إذا لاحظت أن التلميذ(ة) لم يتحدث(تتحدث)، طرح السؤال التالي:

ماذا تحب(ين) أن تفعل(ي) في المنزل ؟

الموافقة الشفهية:

أيها التلميذ(ة)المحترم(ة) اسمح(ي) لي أن أقول لك لماذا أنا معك اليوم. أنا أستاذ أحاول أن أفهم كيف تعلم التلاميذ والتلميذات القراءة. أنت من بين عدة تلاميذ وتلميذات تم اختيارهم(هن) للمشاركة في أنشطة القراءة

سأطلب منك أن تقرأ(ئي) بعض الحروف وبعض الكلمات، وقصة قصيرة بلغة الإشارة، ثم مشاهدة فيديو بلغة الإشارة

سأستعمل هذا الجهاز(اللوحة الإلكترونية) من أجل تسجيل أجوبتك وقياس الوقت الذي تستغرقه أو تستغرقينه في القراءة

هذا ليس امتحانا وليس له أي تأثير على نقطك كيف ما كانت أجوبتك

أستاذك (تك) لن يكون على علم بأجوبتك

سأطرح عليك بعض الأسئلة عن حياتك بالمنزل

لك الاختيار أن تشارك/كي أو لا تشارك/كي

إذا قبلت المشاركة، لست مضطرا(مضطرة) للجواب عن جميع الأسئلة

هل لديك أسئلة حول هذا النشاط؟ هل تريد أن تشارك/كي؟

☐ تمت الموافقة من التلميذ/ التلميذة على المشاركة؟

Letter Name Identification

هذه الصفحة ملينة بالأحرف الأبجدية . رجاء أعطني إشارة اسم جميع ما تستطيع من أسماء الأحرف. فعلى سبيل المثال إشارة اسم هذا الحرف (أشر إلى الحرف د) **هو " د" .**

الآن حاول/(ي) أنت : أعطني إشارة اسم هذا الحرف (أطلب من التلميذ/التلميذة أن يتعرف على إشارة اسم حرف "ل")

فإذا استطاع (ت) التلميذ/التلميذة أن يعطي/تعطي إشارة اسم الحرف بشكل صحيح فقل له/لها **أحسنت،إشارة اسم هذا الحرف "ل".**
أما إذا أخطأ(ت) التلميذ/التلميذة فقل له/لها **إشارة اسم هذا الحرف هي "ل".**

الآن حاول/(ي) مرة أخرى: أعطني إشارة اسم هذا الحرف (اطلب من التلميذ/التلميذة يتعرف على إشارة اسم حرف **"هـ").**

فإذا استطاع (ت) التلميذ/التلميذة أن يعطي اسم إشارة الحرف بشكل صحيح، فقل له/لها **أحسنت، إشارة اسم هذا الحرف " هـ".**
أما إذا أخطأ(ت) التلميذ/ التلميذة فقل له/لها **إشارة اسم هذا الحرف هي "هـ". هل تفهم/ين ما هو مطلوب منك ؟**

عندما أقول لك " ابدأ " أعطني إشارة كل حرف. انتبه /هي للقراءة من اليمين إلى اليسار، حرفا بحرف وسطرا بسطر. هل فهمت المطلوب منك ؟ ضع/ضعي أصبعك على الحرف الأول. حاول/(ي) أن تقرأ/ئي بسرعة وبدقة. سوف ألتزم الصمت وأستمع لما تقول/لين ، مستعد(ة)؟ "لنبدأ".

د - ل - هـ

ل	ء	ت	ي	ب	ا	ب	ج	ح	ت
ل	ف	ء	ا	ت	ح	و	د	ل	ن
و	ى	ت	ل	س	ا	هـ	ء	م	ر
ص	ف	و	ا	ت	د	ن	ء	ا	خ
ل	ن	ا	ب	ح	ء	د	ا	م	ء
ف	ر	ي	ا	م	هـ	ي	هـ	ش	و
ك	ذ	ط	ع	ن	ا	ل	ا	ي	ا
ر	ا	ي	ض	ب	ي	ر	م	ي	ز
م	ل	ر	ع	س	م	غ	ج	و	س
ف	ن	ر	ل	ق	ل	ك	ع	ل	ا

Time Remaining

Autostop? ☐

Video Review

يجب مراجعة الفيديو ووضع علامة على هذه المهمة الفرعية لاحقا؟

☐ نعم ☐ لا

Syllable Identification (1-5)

تعرف الحروف (المقاطع الصوتية):

سنلعب لعبة تعرف الحروف (المقاطع الصوتية). **هذه ورقة تحتوي على حروف** (مقاطع صوتية)**عربية** (أضع الورقة أمام التلميذ(ة) بشكل يسجعله /ها يراها(تراها) جيدا). **المطلوب منك هو قراءة الحروف** (المقاطع الصوتية).

والآن إقرأ / ي الحرف (المقطع الصوتي) (وأشير إلى الحرف (المقطع الصوتي) "قَ ")

إذا كان جواب التلميذ (ة) صحيحا أقول له: **حسن، قَ " تقرأ "قَ"**

إذا كان جواب التلميذ (ة) غير صحيح، أقول له/لها : **" قَ " تقرأ " قَ ". أعد/أعيدي مرة أخرى " قَ ".**

لنجرب حرفا آخر.

إقرأ / ي هذا الحرف (المقطع الصوتي) (وأشير إلى الحرف (المقطع الصوتي) " عِ ")

إذا كان جواب التلميذ (ة) صحيحا أقول له/لها: **حسن، " عِ " تقرأ ، " عِ "**

إذا كان جواب التلميذ (ة) غير صحيح، أقول له/لها: **" عِ " تقرأ " عِ " . أعد/أعيدي مرة أخرى " عِ ".**

إقرأ / ي هذا الحرف (المقطع الصوتي) (وأشير للحرف (المقطع الصوتي) " دِ")

إذا كان جواب التلميذ (ة) صحيحا أقول له/لها: **حسن، "دِ" تقرأ :"دِ".**

إذا كان جواب التلميذ (ة) غير صحيح، أقول له/لها: هذا الحرف هو **"دِ". أعد/أعيدي مرة أخرى " دِ "**

عندما أقول لك "لنبدأ"، ركز جيدا و اقرأ/ي الحروف (المقاطع الصوتية). **ستبدأ من هنا** (أضع أصبع التلميذ(ة) تحت الحرف الأول في السطر الأول) **وتستمر من اليمين إلى اليسار حرفا بحرف وسطرا بسطر** (أوضح هذا الاتجاه بواسطة أصبعه).

أنت مستعد(ة)؟ "لنبدأ"

1. مَ

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

2. يْ

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

3. ةْ

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

4. قَ

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

5. مِ

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

Syllable Identification (6-10)

6. طـ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
7. با	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
8. بُ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
9. ظُ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
10. لأ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة

Syllable Identification (11-15)

11. قـ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
12. بي	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
13. لـ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
14. نـ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة
15. ظـ	☐ غير صحيحة	☐ لا إجابة	☐ صحيحة

Syllable Identification (16-20)

16 . غ

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

17 .ظ

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

18 .صا

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

19. ث

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

20 .ن

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

Syllable Identification (21-25)

21. ز

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

22 .غ

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

23 .ثْ

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

24 .ذْ

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

25. أ

صحيحة	غير صحيحة	لا إجابة
☐	☐	☐

Time Remaining

Autostop? ☐

Video Review

يجب مراجعة الفيديو ووضع علامة على هذه المهمة الفرعية لاحقًا؟

☐ نعم ☐ لا

Familiar Word Reading

فيما يلي بعض الكلمات. أريد منك أن تقرأ/ي لي جميع ما تستطيع/عين قراءته من الكلمات المعروضة أمامك. هنا توجد ثلاثة أمثلة.
هذا مثال على ذلك (أشر بالأصبع إلى كلمة " نَعَمْ" وقم بإشارة : " نَعَمْ") **الآن جاء دورك : اقرأ/ي لي هذه الكلمة** (في حالة إجابة غير صحيحة أو لا إجابة لمدة 3 ثوان أقرأ الكلمة للتلميذ/ التلميذة).

الآن حاول/(ي) أنت : اقرأ/ي لي هذه الكلمة (أشر بالأصبع إلى كلمة "فَمْ"). ، إذا أجاب التلميذ/التلميذة بشكل صحيح، فقل **أحسنت ، هذه الكلمة هي "فَمْ".**
أما إذا أخطأ/ت التلميذ/التلميذة ،أو لم يقدم إجابة لمدة 3 ثوان فقل **هذه الكلمة هي "فَمْ".**

الآن حاول/(ي) أنت : اقرأ/ي هذه الكلمة (أشر بالأصبع كلمة "اسْمْ"). ، إذا أجاب/ت التلميذ/التلميذة بشكل صحيح، فقل **أحسنت ، هذه الكلمة هي "اسْمْ".**
أما إذا أخطأ/ت التلميذ/التلميذة ،أو لم يقدم إجابة لمدة 3 ثوان فقل **هذه الكلمة هي "اسْمْ".**

نَعَمْ - فَمْ - اسْمْ

كُرةٌ	أصْفَرُ	أُمّ	دَجاجَةٌ	كِتَابٌ
أنتَ	مَلْ	مَاءٌ	بَيْتٌ	رَسَمَ
سِنٌّ	سَمِعَ	مَنْزِلٌ	قِطَّةٌ	بابٌ
أنَا	قالَ	صَبَاحٌ	بِنْتٌ	طَبِيبٌ
قَرَأَ	تِلْمِيذٌ	غَدًا	أحَبَّ	مَعَ
فَرِحَ	لَعِبَ	مَاذَا	صُورَةٌ	أحْمَرُ
مَدْرَسَةٌ	أسَدٌ	شُكْرًا	كَتَبَ	في
ذَهَبَ	هُوَ	يَدٌ	فِيلٌ	أكَلَ
أبٌ	هاتِفٌ	أكَلَ	وَرْدَةٌ	طِفْلٌ
هُوَ	أرْنَبٌ	إلى	لا	صِفْرٌ

Time Remaining

Autostop? ☐

Video Review

يجب مراجعة الفيديو ووضع علامة على هذه المهمة الفرعية لاحقًا؟

☐ لا ☐ نعم

Reading Passage - Story 2 في الصّبَاحِ ("In the morning")

لعبتنا في القراءة مستمرة، هذه قصة قصيرة (ضع الورقة أمام التلميذ/التلميذة بشكل يمكنه/ها من رؤيتها جيدا). **المطلوب منك هو قراءة هذه القصة إشاريا، في دقيقتين. حاول/لي أن تفهم/ي معاني الكلمات الواردة في القصة. انتبه/هي للقراءة من اليمين إلى اليسار،كلمة كلمة وسطرا سطرا. إقرأ/ي بسرعة وبدقة . حين ستنتهي، سأطرح عليك بعض الأسئلة حول القصة. هل فهمت ما هو مطلوب منك؟ حين سأقول لك لنبدأ"، اقرأ/ي القصة:**

سَلْمَى	بِنْتٌ	نَشِيطَةٌ،	عُمْرُهَا	سِتُّ
سَنَوَاتٍ.	فَرِحَتْ	بِالْعَوْدَةِ	إِلَى	الْمَدْرَسَةِ
فِي	بِدَايَةِ	الْأُسْبُوعِ	تَسْتَيْقِظُ	سَلْمَى
بَاكِرًا	كُلَّ	صَبَاحٍ.	تَغْسِلُ	يَدَيْهَا
وَوَجْهَهَا،	وَتَنْظِّفُ	أَسْنَانَهَا	بِالْفُرْشَاةِ	وَالسُّنُونِ.
تَقُولُ	سَلْمَى	"صَبَاحُ	الْخَيْرِ	يَا
أُمِّي،	صَبَاحُ	الْخَيْرِ	يَا	أَبِي".
وَتُقَبِّلُ	أَخَاهَا	يُوسُفَ.	تَتَنَاوَلُ	الْفُطُورَ
مَعَ	أُسْرَتِهَا	ثُمَّ	تَذْهَبُ	إِلَى
الْمَدْرَسَةِ.				

Time Remaining

Autostop?

Video Review

يجب مراجعة الفيديو ووضع علامة على هذه المهمة الفرعية لاحقًا؟

☐ نعم ☐ لا

Reading Passage Comprehension - Story 2 في الصّبَاح ("In the morning")

فهم القصة المقروءة

سأضع عليك الآن بعض الأسئلة حول القصة التي قرأت. حاول(ي) أن تجيب/ي على أكبر عدد ممكن من الأسئلة.

كَمْ عُمْرُ سَلْمَى؟

صحيحة	☐	غير صحيحة	☐	لا إجابة	☐

متى تَسْتَيْقِظُ سَلْمَى؟

صحيحة	☐	غير صحيحة	☐	لا إجابة	☐

مَنْ تُحَيِّ سَلْمَى أوّلاً؟

صحيحة	☐	غير صحيحة	☐	لا إجابة	☐

أَيْنَ تَذْهَبُ سَلْمَى بَعْدَ الفَطُورِ؟

صحيحة	☐	غير صحيحة	☐	لا إجابة	☐

مَا اسْمُ اليَوْمِ الَّذِي عَادَتْ فِيهِ سَلْمَى إِلَى المَدْرَسَةِ؟

صحيحة	☐	غير صحيحة	☐	لا إجابة	☐

Date/Time

Date	
Time	

02 Endline 2018 Part 2

MSL Vocabulary, MSL Comprehension

Enumerator Name	

Date and Time

Date	
Time	

School

School Name	
School Name (English)	
Student Name	
Student ID	

Student Name Verification

Is this [Student Name]?

☐ لا ☐ نعم

Transition Comment

Random ID

Random ID	

MSL Vocabulary

اختبار المعجم

تعليمات للتلاميذ:

سأريك فيديو لكلمة بلغة الإشارة
سأريك الفيديو مرتين
سأطلب منك تعيين الصورة المناسبة للفيديو
عندما تشاهد الفيديو عين الصورة المناسبة له

تعليمات للممرر:

-أعرض على التلميذ مرتين فيديو كل صورة على حدة .
-أطلب من التلميذ أن يعين الصورة الصحيحة
-إذا عين التلميذ أكثر من صورة، ضع علامة على آخر جواب سواء كان صحيحا أو خاطئا
-إذا لم يعرف التلميذ(ة) الجواب، اختر " لا إجابة".

1. [حافلة]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

2 . [سلطة]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

3 . [شوكولاطة]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

4. [لعب]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

5 . [وضع]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

6. [مريض]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

7. [سرير]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

8. [قطار]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

9. [ملعب]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

10. [نافذة]
صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

MSL Comprehension

ليس هناك ورقة خاصة بالتلميذ/ بالتلميذة في هذا الجزء من النشاط. يتابع التلميذ(ة) فيديو لقصة قصيرة بلغة الإشارة.

تابع/ي جيدا من فضلك، سأطرح عليك بعض الأسئلة وحاول/ي أن تجيب/ي قدر الإمكان. هل فهمت المطلوب منك؟

مع من يلعب سمير في الحديقة؟

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

ماذا شرب الأطفال؟

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

لماذا سقط سمير ؟

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

بم شعر سمير في الحديقة؟

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

لماذا صاح سمير "النجدة،النجدة"؟

صحيحة ☐ غير صحيحة ☐ لا إجابة ☐

Date/Time

Date	
Time	

Annex B: **EGRSLA Instrument Reliability**

Table B.1: **Reliability Results for Baseline EGRSLA**

Subtask	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Letter Name Identification	0.657	0.835
Syllable Identification	0.673	0.832
Familiar Word Reading	0.803	0.802
Reading Passage	0.698	0.827
Reading Passage Comprehension	0.681	0.841
MSL Comprehension	0.505	0.858
	EGRSLA Coefficient Alpha	**0.858**

Table B.2: **Reliability Results for Endline EGRSLA**

Subtask	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Letter Name Identification	0.676	0.836
Syllable Identification	0.610	0.849
Familiar Word Reading	0.812	0.810
Reading Passage	0.737	0.827
Reading Passage Comprehension	0.657	0.843
MSL Comprehension	0.504	0.864
	EGRSLA Coefficient Alpha	**0.863**

Annex C: **EGRSLA Relationships Between Subtasks**

The EGRSLA is a new assessment used to measure the reading level of students who are deaf or hard of hearing. Correlations between student scores on all subtasks were analyzed to understand better how the different subtasks are related. Similar to the baseline assessment, correlations between subtasks at the endline were statistically significant ($p<0.05$) and positive at both grade levels. This indicates that a higher performance on a given subtask was related to higher performance on other subtasks. The exception was the relationship between the syllable identification and reading comprehension subtasks in grade 1, which was not found to be statistically significant. This exception can be explained in part by the high prevalence of zero scores on the reading passage subtask, wherein students who could perform a foundational reading skill were unable to translate the skill to reading a complete passage fluently and accurately at the time of assessment.

For grade 1 students, there was a notably strong relationship ($r=.756$, $p<0.01$) between the letter name identification and syllable name identification subtasks. For grade 2 students, there was a strong relationship ($r=.821$, $p<0.01$) between the familiar word reading and reading passage subtasks. Considered together, these results suggest a positive trajectory for students' reading skills development from grade 1 to grade 2: foundational skills predict performance on higher-level foundational skills and eventually reading with fluency and accuracy. Along these lines, the statistically significant relationship between MSL comprehension and vocabulary skills with the EGRSLA subtasks underscores the linkage between these skills and reading with fluency.

Table C.1: **Correlation Matrix Between EGRSLA Subtasks and MSL Vocabulary Assessment – Grade 1**

	Letter name identification	Syllable Identification score	Familiar word reading	Reading passage	Reading passage comprehension score	MSL comprehension score	MSL vocabulary score
Letter name identification	1						
Syllable identification score	.756**	1					
Familiar word reading	.666**	.513**	1				
Reading passage	.402**	.272*	.645**	1			
Reading passage comprehension score	.328**	0.200	.535**	.902**	1		
MSL comprehension score	.362**	.251*	.451**	.535**	.439**	1	
MSL vocabulary score	.652**	.660**	.489**	.384**	.341**	.328**	1

Note: Two asterisks (**) denotes correlation is significant at the 0.01 level (2-tailed). One asterisk (*) denotes correlation is significant at the 0.05 level (2-tailed).

Table C.2: **Correlation Matrix Between EGRSLA Subtasks and MSL Vocabulary Assessment – Grade 2**

	Letter name identification	Syllable Identification score	Familiar word reading	Reading passage	Reading passage comprehension score	MSL comprehension score	MSL vocabulary score
Letter name identification	1						
Syllable identification score	.695**	1					
Familiar word reading	.565**	.559**	1				
Reading passage	.403**	.375**	.851**	1			
Reading passage comprehension score	.360**	.355**	.686**	.821**	1		
MSL comprehension score	.395**	.235*	.533**	.474**	.564**	1	
MSL vocabulary score	.606**	.564**	.583**	.358**	.331**	.389**	1

Note: Two asterisks (**) denotes correlation is significant at the 0.01 level (2-tailed). One asterisk (*) denotes correlation is significant at the 0.05 level (2-tailed).

Annex D: **Additional EGRSLA Results**

Table D.1: **EGRSLA and MSL Vocabulary Assessment Mean Scores by Gender, Grade, and Timepoint**

Subtask	Time	Grade 1				Grade 2			
		Boys (*n* = 43)		Girls (*n* = 19)		Boys (*n* = 41)		Girls (*n* = 30)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Letter Name Identification	Baseline	57.9	34.0	53.9	40.9	77.0	39.4	82.4	42.8
	Endline	68.6	33.4	70.8	34.1	86.2	35.4	90.1	31.5
Syllable Identification	Baseline	14.1	8.1	14.0	8.2	16.9	7.6	17.8	5.8
	Endline	17.9	7.6	16.8	7.1	18.9	6.9	19.8	5.2
Familiar Word Reading	Baseline	12.0	18.6	15.9	22.8	16.1	18.9	21.2	26.3
	Endline	13.8	20.4	17.4	21.6	20.6	18.8	31.4	28.2
Reading Passage	Baseline	3.1	7.4	9.4	16.0	8.0	16.5	18.9	30.8
	Endline	2.8*	6.3	12.5*	19.1	9.4	15.8	18.9	26.0
Reading Passage Comprehension	Baseline	0.2	0.5	0.6	1.1	0.3	0.7	0.6	0.9
	Endline	0.1	0.4	0.6	1.1	0.5	1.0	0.8	1.3
MSL Comprehension	Baseline	0.1	2.4	0.4	2.5	0.3	1.5	0.7	2.1
	Endline	0.2	1.9	0.5	2.5	0.6	1.5	0.8	1.7
MSL Vocabulary	Baseline	6.3	0.4	6.9	1.0	7.8	1.0	7.2	1.2
	Endline	7.5	0.5	6.8	1.2	8.3	1.2	8.0	1.4

Note: An asterisk (*) indicates the average EGRSLA scores for boys and girls were statistically significantly different at $p<0.05$.

Table D.2: **Percentage of Students Receiving Zero Scores by Gender, Grade, and Timepoint**

Subtask	Time	Grade 1		Grade 2	
		Boys (*n* = 43)	Girls (*n* = 19)	Boys (*n* = 41)	Girls (*n* = 30)
Letter Name Identification	Baseline	0.0%	10.5%	0.0%	0.0%
	Endline	0.0%	5.3%	0.0%	0.0%
Syllable Identification	Baseline	4.7%	10.5%	0.0%	0.0%
	Endline	2.3%	5.3%	0.0%	0.0%
Familiar Word Reading	Baseline	46.5%	42.1%	34.1%	23.3%
	Endline	39.5%	42.1%	24.4%	23.3%
Reading Passage	Baseline	79.1%	63.2%	68.3%	46.7%
	Endline	79.1%	52.6%	56.1%	43.3%
Reading Passage Comprehension	Baseline	88.4%	68.4%	82.9%	60.0%
	Endline	90.7%	68.4%	75.6%	66.7%
MSL Comprehension	Baseline	93.0%	78.9%	87.8%	66.7%
	Endline	86.0%	78.9%	73.2%	70.0%
MSL Vocabulary	Baseline	0.0%	0.0%	0.0%	0.0%
	Endline	0.0%	0.0%	0.0%	0.0%

Note: An asterisk (*) indicates the percentage of zero scores for boys and girls were significantly different at $p<0.05$.

Table D.3: **EGRSLA and MSL Vocabulary Assessment Mean Scores by School and Grade at Baseline**

	Subtask	School A		School B		School C		School D		School E		School F		School G		School H	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Grade 1	Letter Name Identification	36.0	20.5	33.7	31.7	79.8	25.0	93.8	22.7	61.7	46.8	14.8	18.1	69.1	20.6	49.6	29.9
	Syllable Identification	8.3	12.7	8.8	7.2	21.9	1.4	16.4	4.0	15.8	10.0	4.5	5.3	19.8	2.3	11.2	4.8
	Familiar Word Reading	1.0	1.7	0.2	0.4	41.8	19.6	29.4	15.6	9.6	17.7	0.0	0.0	6.8	4.5	0.0	0.0
	Reading Passage	0.0	0.0	0.0	0.0	13.4	11.2	17.6	22.4	3.2	7.2	0.0	0.0	1.4	1.9	0.0	0.0
	Reading Passage Comprehension	0.0	0.0	0.0	0.0	0.9	0.8	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MSL Comprehension	0.0	0.0	0.1	0.2	0.8	1.3	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MSL Vocabulary	5.3	1.5	5.5	2.2	8.8	0.5	9.0	1.0	5.4	1.3	3.5	2.4	6.4	2.3	5.7	2.9
Grade 2	Letter Name Identification	41.6	23.7	50.5	37.0	86.0	36.2	105.6	35.0	73.8	25.2	101.4	30.0	74.3	25.8	121.5	30.0
	Syllable Identification	11.8	3.6	10.5	7.1	19.3	5.3	21.1	2.8	20.3	0.6	18.5	5.4	20.5	4.9	23.3	1.9
	Familiar Word Reading	3.1	4.7	1.9	5.3	48.6	28.9	42.8	12.4	4.3	0.6	9.1	9.8	9.7	8.2	20.9	10.3
	Reading Passage	0.6	0.5	0.9	2.3	52.8	39.0	18.4	17.1	0.0	0.0	0.0	0.0	7.3	8.5	11.4	15.8
	Reading Passage Comprehension	0.0	0.0	0.1	0.2	1.7	1.2	0.6	0.7	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.9
	MSL Comprehension	0.0	0.0	0.0	0.0	1.6	1.6	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.8	2.0
	MSL Vocabulary	4.8	2.2	6.9	1.4	8.6	1.3	8.6	0.7	6.7	1.5	7.5	1.6	6.7	1.5	9.5	0.8

Note: Sample sizes (*n*) not included to maintain confidentiality.

Table D.4: **EGRSLA and MSL Vocabulary Assessment Mean Scores by School and Grade at Endline**

	Subtask	School A		School B		School C		School D		School E		School F		School G		School H	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Grade 1	Letter Name Identification	42.0	24.0	58.3	32.1	87.1	22.4	99.3	27.1	71.1	48.0	26.3	27.0	74.3	22.3	64.1	25.3
	Syllable Identification	14.3	6.0	12.8	6.9	23.4	2.0	21.6	1.9	18.2	9.8	8.3	9.9	22.3	2.6	15.5	6.4
	Familiar Word Reading	1.0	1.7	0.5	1.1	33.4	13.4	38.1	19.4	31.0	37.9	0.0	0.0	10.0	8.8	1.7	3.2
	Reading Passage	0.0	0.0	0.1	0.5	12.4	14.5	20.9	23.5	8.0	9.9	0.0	0.0	2.8	6.5	0.0	0.0
	Reading Passage Comprehension	0.0	0.0	0.0	0.0	0.7	0.9	1.1	1.3	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
	MSL Comprehension	0.0	0.0	0.0	0.0	1.0	1.1	0.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MSL Vocabulary	5.3	1.5	6.3	2.4	8.8	0.7	8.7	1.0	5.8	2.9	5.5	1.3	8.0	1.1	7.8	1.9
Grade 2	Letter Name Identification	56.2	27.6	69.6	30.6	95.6	37.4	97.7	21.8	73.7	13.3	97.4	33.4	92.2	26.8	121.9	30.3
	Syllable Identification	15.4	5.6	13.9	8.0	20.5	4.4	22.6	1.5	22.0	2.0	21.7	2.7	21.2	4.6	23.4	1.8
	Familiar Word Reading	4.4	6.2	3.6	8.5	54.1	27.5	43.0	13.4	35.9	3.5	18.2	7.7	22.0	17.7	36.0	16.7
	Reading Passage	0.6	0.5	0.7	2.4	37.2	35.1	24.6	14.4	2.7	2.3	5.1	6.5	13.4	17.0	18.0	22.6
	Reading Passage Comprehension	0.0	0.0	0.1	0.2	1.9	1.9	1.0	1.1	0.0	0.0	0.5	1.2	0.3	0.7	1.0	1.1
	MSL Comprehension	0.0	0.0	0.0	0.0	2.5	2.0	0.7	0.8	0.0	0.0	0.5	0.8	0.0	0.0	1.6	1.4
	MSL Vocabulary	5.2	2.2	7.1	1.3	9.1	0.9	9.2	0.4	8.3	0.6	8.7	1.0	8.2	1.3	9.5	0.8

Note: Sample sizes (*n*) not included to maintain confidentiality.

Annex E: **Teacher and Student Questionnaire Results**

Table E.1: **School Personnel**

School	# of Deaf Teachers	# of Hearing Teachers	# of Deaf Assistants	# of Hearing Assistants	# of Speech Therapists
School A	3	9	2	0	2
School B	2	6	1	0	2
School C	0	2	0	0	1
School D	0	4	2	0	1
School E	0	2	0	0	0
School F	0	1	1	0	0
School G	0	9	0	0	0
School H	4	5	2	2	1

Table E.2: **School Structure and Capacity**

School	Total # of Students	# of Classes that are Multigrade	Attached to another school?
School A	71	2	Yes
School B	167	0	No
School C	24	0	Yes
School D	82	0	No
School E	14	1	Yes
School F	13	1	Yes
School G	97	0	No
School H	53	0	No

Table E.3: **Baseline Student Questionnaire Results**

		Grade					
		Grade 1		Grade 2		Total	
		Count	Column *N* %	Count	Column *N* %	Count	Column *N* %
Where did you learn to sign? - At home	Not Selected	47	75.8%	57	80.3%	**104**	**78.2%**
	At home	15	24.2%	14	19.7%	**29**	**21.8%**
Where did you learn to sign? - At school	Not Selected	29	46.8%	21	29.6%	**50**	**37.6%**
	At school	33	53.2%	50	70.4%	**83**	**62.4%**
Where did you learn to sign? - Other	Not Selected	62	100.0%	71	100.0%	**133**	**100.0%**
	Other	0	0.0%	0	0.0%	**0**	**0.0%**
Where did you learn to sign? - No response/don't know	Not Selected	48	77.4%	64	90.1%	**112**	**84.2%**
	No response/don't know	14	22.6%	7	9.9%	**21**	**15.8%**
How old were you when you learned to sign?	2-6 years old	9	14.5%	14	19.7%	**23**	**17.3%**
	7-11 years old	12	19.4%	14	19.7%	**26**	**19.5%**
	12-15 years old	1	1.6%	4	5.6%	**5**	**3.8%**
	Other	0	0.0%	0	0.0%	**0**	**0.0%**
	No response/don't know	40	64.5%	39	54.9%	**79**	**59.4%**
Is someone in your family deaf or hard of hearing? - Yes, father	Not Selected	24	38.7%	21	29.6%	**45**	**33.8%**
	Yes, father	38	61.3%	50	70.4%	**88**	**66.2%**
Is someone in your family deaf or hard of hearing? - Yes, mother	Not Selected	61	98.4%	67	94.4%	**128**	**96.2%**
	Yes, mother	1	1.6%	4	5.6%	**5**	**3.8%**
Is someone in your family deaf or hard of hearing? - Yes, sibling	Not Selected	62	100.0%	67	94.4%	**129**	**97.0%**
	Yes, sibling	0	0.0%	4	5.6%	**4**	**3.0%**
Is someone in your family deaf or hard of hearing? - Yes, another family member	Not Selected	53	85.5%	56	78.9%	**109**	**82.0%**
	Yes, another family member	9	14.5%	15	21.1%	**24**	**18.0%**
Is someone in your family deaf or hard of hearing? - No response/don't know	Not Selected	61	98.4%	68	95.8%	**129**	**97.0%**
	No response/ don't know	1	1.6%	3	4.2%	**4**	**3.0%**
Is someone in your family deaf or hard of hearing? - No	Not Selected	47	75.8%	68	95.8%	**115**	**86.5%**
	No	15	24.2%	3	4.2%	**18**	**13.5%**

Table E.3: **Baseline Student Questionnaire Results** (continued)

		Grade					
		Grade 1		Grade 2		Total	
		Count	Column *N* %	Count	Column *N* %	Count	Column *N* %
Do you communicate with someone in your family in MSL?	Never	2	3.2%	2	2.8%	**4**	**3.0%**
	Yes, sometimes	28	45.2%	45	63.4%	**73**	**54.9%**
	Yes, always	24	38.7%	23	32.4%	**47**	**35.3%**
	No response/don't know	8	12.9%	1	1.4%	**9**	**6.8%**
Can anyone in your household read? - Yes, father	Not Selected	59	95.2%	70	98.6%	**129**	**97.0%**
	Yes, father	3	4.8%	1	1.4%	**4**	**3.0%**
Can anyone in your household read? - Yes, mother	Not Selected	29	46.8%	23	32.4%	**52**	**39.1%**
	Yes, mother	33	53.2%	48	67.6%	**81**	**60.9%**
Can anyone in your household read? - Yes, sibling	Not Selected	37	59.7%	35	49.3%	**72**	**54.1%**
	Yes, sibling	25	40.3%	36	50.7%	**61**	**45.9%**
Can anyone in your household read? - Yes, another family member	Not Selected	37	59.7%	28	39.4%	**65**	**48.9%**
	Yes, another family member	25	40.3%	43	60.6%	**68**	**51.1%**
Can anyone in your household read? - No	Not Selected	62	100.0%	71	100.0%	**133**	**100.0%**
	No	0	0.0%	0	0.0%	**0**	**0.0%**
Can anyone in your household read? - No response/don't know	Not Selected	53	85.5%	67	94.4%	**120**	**90.2%**
	No response/don't know	9	14.5%	4	5.6%	**13**	**9.8%**

Table E.3: **Baseline Student Questionnaire Results** (continued)

		Grade					
		Grade 1		Grade 2		Total	
		Count	Column *N* %	Count	Column *N* %	Count	Column *N* %
How often do you communicate with your teacher in MSL?	Never	2	3.2%	1	1.4%	**3**	**2.3%**
	Sometimes	32	51.6%	33	46.5%	**65**	**48.9%**
	Always	24	38.7%	34	47.9%	**58**	**43.6%**
	No response/don't know	4	6.5%	3	4.2%	**7**	**5.3%**
How often do you communicate with your friends in MSL?	Never	1	1.6%	1	1.4%	**2**	**1.5%**
	Sometimes	28	45.2%	32	45.1%	**60**	**45.1%**
	Always	27	43.5%	36	50.7%	**63**	**47.4%**
	No response/don't know	6	9.7%	2	2.8%	**8**	**6.0%**
Did you go to preschool before first grade?	No	18	29.0%	24	33.8%	**42**	**31.6%**
	Yes	36	58.1%	44	62.0%	**80**	**60.2%**
	No response/don't know	8	12.9%	3	4.2%	**11**	**8.3%**

Table E.4: **Student Age at Baseline**

	Grade 1	Grade 2
n	37	60
# Missing	25	11
Mean	10.76	12.37
Minimum	6	8
Maximum	17	19

Table E.5: **Endline Teacher Questionnaire Results**

Question	Response Option	Frequency	%
Have you received any trainings from the project?	Yes	12	92.3%
	No	1	7.7%
Do you have a computer in your classroom that only you use?	Yes	11	84.6%
	No	2	15.4%
For what purpose do you use the software?	I use the dictionary or thesaurus to teach my students MSL	11	84.6%
	I use the dictionary or thesaurus to support my learning of MSL	10	76.9%
	I use the publisher to make and print materials	10	76.9%
	Don't know	0	0.0%
In an average week, how frequently do you use the dictionary or thesaurus to teach your students MSL?	Everyday	6	54.5%
	2-4 times a week	5	45.5%
	1 time a week or less	0	0.0%
In an average week, how frequently do you use the dictionary or thesaurus to support your learning of MSL?	Everyday	5	50.0%
	2-4 times a week	5	50.0%
	1 time a week or less	0	0.0%
In an average week, how frequently do you use the software to make and print materials?	Everyday	1	10.0%
	2-4 times a week	7	70.0%
	1 time a week or less	2	20.0%
What materials do you make using the software?	Worksheets for students	11	84.6%
	Flashcards	8	61.5%
	Posters	8	61.5%
	Storybooks	7	53.8%
	PowerPoints	2	15.4%
	Other	4	30.8%

Table E.5: **Endline Teacher Questionnaire Results** (continued)

Question	Response Option	Frequency	%
How do you use the materials you make?	I use them in my classroom	13	100.0%
	I give them to students for homework	11	84.6%
	I give them to parents as handouts	6	46.2%
	I give them to other teachers in my school	5	38.5%
	Other	1	7.7%
Do you allow your students to use the software themselves?	Yes	11	84.6%
	No	2	15.4%
In an average week, how often do you let them use the software themselves?	Everyday	3	27.3%
	2-4 times a week	4	36.4%
	1 time a week or less	4	36.4%
Do you use the software at home?	Yes	4	30.8%
	No	9	69.2%
In your opinion, what is the greatest benefit of the software?	It helps me learn MSL	1	7.7%
	It allows me to create materials to support my teaching	6	46.2%
	It helps my students learn MSL	2	15.4%
	It provides me with examples to improve my teaching	4	30.8%
	Other	0	0.0%
What challenges have you had with the software?	Computer isn't functioning	0	0.0%
	Don't know how to use the computer	1	7.7%
	Computer with software isn't available	0	0.0%
	Software isn't functioning	0	0.0%
	Don't know how to use the software	0	0.0%
	Software doesn't have the vocabulary	9	69.2%
	Other	3	23.1%
	No challenges	2	15.4%

Table E.5: **Endline Teacher Questionnaire Results** (continued)

Question	Response Option	Frequency	%
What other technology do you use to support your classroom teaching?	Tablets	1	7.7%
	Smartphones	8	61.5%
	Smartboard	7	53.8%
	Other	3	23.1%
	I don't use any other technology	0	0.0%
Does your school engage parents or caretakers in their students' learning?	Yes	8	61.5%
	No	5	38.5%
Have you received training or support for teaching reading from anyone other than the project in the past year?	Yes	8	61.5%
	No	5	38.5%
Have you received MSL support from anyone other than the project in the past year?	Yes	9	69.2%
	No	4	30.8%
How much has your students' Arabic reading skills been improved by the project?	A lot	6	46.2%
	Somewhat	7	53.8%
	Very little	0	0.0%
	Not at all	0	0.0%
How much has your students' MSL skills been improved by the project?	A lot	7	53.8%
	Somewhat	5	38.5%
	Very little	1	7.7%
	Not at all	0	0.0%

Table E.5: **Endline Teacher Questionnaire Results** (continued)

Question	Response Option	Frequency	%
How much do you agree with the following statement: I believe that my students can learn to read.	Strongly agree	8	61.5%
	Agree	5	38.5%
	Disagree	0	0.0%
	Strongly disagree	0	0.0%
How much do you agree with the following statement: I believe that my students should communicate using MSL.	Strongly agree	10	76.9%
	Agree	3	23.1%
	Disagree	0	0.0%
	Strongly disagree	0	0.0%
How much do you agree with the following statement: I believe that I should teach using MSL instead of using oral language.	Strongly agree	4	30.8%
	Agree	6	46.2%
	Disagree	3	23.1%
	Strongly disagree	0	0.0%