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A VOICE FOR EVERY CHILD THROUGH OPEN-SOURCE SOLUTIONS AND RESOURCES

Supporting complex communication needs with inclusive innovations

2022

About the case studies: To document UNICEF's work on disability and inclusion in the Europe and Central Asia region, we have developed a set of case studies that can be read together or stand alone.

UNICEF takes a comprehensive approach to inclusion, working to ensure that all children have access to vital services and opportunities. When UNICEF speaks about "inclusion" this encompasses children with and without disabilities, marginalized and vulnerable children, and children from minority and hard-to-reach groups.

The case studies have a specific focus on children with disabilities and their families. However, many of the highlighted initiatives are designed for broad inclusion and benefit all children.

In the early years of childhood, the brain develops at an unprecedented pace and children acquire communication and language skills to express their thoughts and needs, interact with others, and learn. Some children, however, do not develop these skills due to impairment or trauma.

Augmentative and alternative communication (AAC) systems are 'non-speech' strategies that can *augment* a child's communication abilities or provide an *alternative* to speech.[1] The documented benefits of integrating AAC interventions include supporting children's comprehension, conversation and social interaction. During their child's early years, parents can use AAC at home in everyday family routines to increase communication and expand

"Children's brains are built, moment by moment, as they interact with their environments. In the first few years of life, more than one million neural connections are formed each second – a pace never repeated again. The quality of a child's early experiences makes a critical difference as their brains develop, providing either strong or weak foundations for learning, health and behaviour throughout life."

UNICEF, 'Early Childhood Development', n.d., www.unicef.org/early-childhood-development

the child's opportunities to participate in significant social experiences, such as day care, preschool and kindergarten.[2]

Assistive technologies designed for AAC and used in a supportive environment can help children develop their abilities to understand and express words and concepts, opening up opportunities to improve developmental outcomes and learning, and to function independently. In turn, this can contribute to educational inclusion, participation and community living, as opposed to social exclusion or institutionalization.

UNICEF Europe and Central Asia estimates that 12,000 children aged 0–6 are in need of AAC solutions in Croatia, Montenegro and Serbia, and throughout the region, 840,000 children could potentially benefit.[3] However, many children with complex communication needs are not identified or referred for AAC services at the appropriate time. This has primarily been due to limitations in three areas:

1. Access to affordable AAC systems that provide appropriate assistive technology, including in local languages;

2. The capacity and attitudes of skilled professionals to identify developmental delays or complex needs of children and apply the key principles of AAC interventions for children aged 0–5; and

3. Evidence in the region of the effectiveness of AAC solutions for young children.

Reaching the children who need this support at the earliest time possible is crucial to enable communication, mitigate the impacts of developmental delays, and provide successful and functional outcomes. Trained and skilled speech and language pathologists and early childhood interventionists are essential to identify the child's strengths and needs (current and future) and to match these to appropriate AAC tools and strategies. It is also important that early childhood development staff and parents are involved in and encouraged to contribute their insights based on their interactions with and knowledge about the child.

By applying the principles of the Convention on the Rights of Persons with Disabilities[4] and the World Health Organization's International Classification of Functioning, Disability and Health[5] to practical solutions, language and communication outcomes for young children with developmental and complex needs can be improved. This case study focuses on UNICEF's work supporting the development of systems that use open-source technology solutions, including the Cboard, and technical resources to provide affordable AAC tools to children in need and

"Oftentimes, commercial solutions are too expensive and have limited language availability, which may render them inaccessible in many low-income countries. Our goal was to make Cboard a solution that works for everyone, everywhere. To accomplish this we chose the web as our platform, enabling us to provide Cboard on desktops, tablets, and mobile phones. There is no installation process, no purchase, just follow a link – and you're good to go."

CIREHA Team, 'Cireha – Augmentative and Alternative Communication Portfolio', UNICEF Innovation Fund, 8 December 2017, <www.unicefinnovationfund.org/broadcast/updates/cireha-augmentative-and-alternative-communication-portfolio>

strengthen national capacities for early intervention in order to address the highlighted challenges of affordability, workforce capacity and generating evidence of impact.

Affordability of technologies

In response to the benefits and challenges described above, the UNICEF Europe and Central Asia Regional Office (ECARO) is working with multiple partners to build an approach to AAC support that focuses on open-source, low-cost technologies and resources that can be adapted to children's needs and local country contexts. In many countries where UNICEF works, the cost of assistive technology, especially digital technologies, can be a significant barrier to children's access to the support they need.

To address this bottleneck, the Cboard initiative, an AAC app for aiding communication with symbols and text-to-speech technology, was developed with UNICEF's support. The basic premise was that piloting open-licence[6] AAC solutions and training – complemented with systems strengthening for early intervention – would create sustainable, affordable models and tools with impact in the pilot countries and for reuse and adaptation in many other countries and contexts.

Cboard[7] is a free-to-use AAC application designed for scalability, accessibility, and the potential to reach children across the world. Among its key features:

- Cboard is entirely based on open-source licensing, through which designers, programmers, speech professionals, parents and institutions provide feedback and contribute to improvements in functions and content, such as translations.

- It is currently available in 44 languages and open to adding more, an important element for increasing equitable access among people with disabilities wherever they live.

- The app operates on web browsers and Android devices such as tablets and mobile phones; offline support for Android is available on Google Chrome. And all services are always free of charge to users.

The development of Cboard began in 2017, when the UNICEF Innovation Fund awarded an investment to CIREHA, an AAC portfolio company based in Argentina.[8] In 2019, ECARO commenced pilot projects that were carried out in **Croatia, Montenegro** and **Serbia**. UNICEF's support includes capacity-building in the use of this AAC technology and assistance in adapting the Cboard to local languages if the desired language is not already available.

In pilot countries, UNICEF also donated Android tablets with the Cboard app for use by children, parents and professionals in Croatia, Montenegro and Serbia. In response to successful testing with significant results during the pilot phase, the initiative was expanded to **Bulgaria** and **North Macedonia** in 2021 and is being scaled up in both countries.

The Cboard innovation developed with support from UNICEF is just one example of low-cost, open-source technology that can be used to support children with complex communication needs. Overall, UNICEF is working to develop a resilient and flexible AAC ecosystem within countries. This encompasses support for highly trained professionals who can adopt a range of technologies to work with children and have the capacities to adapt to emerging technologies and innovations, as well as using low-cost, offline tools where relevant.

Capacity of service providers

A strong workforce is vital for the early identification of children with complex communication needs, and in providing support to the child and their family to adopt tools and technologies that can assist the child. Strong coordination is needed to create a supportive ecosystem from the national level through to the individual child and her or his family.

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A system of AAC support promotes interaction and helps children overcome communication difficulties and impairments. Intrinsically, this support system provides guidance to family members, other caregivers and educators in the child's life, and opens opportunities for children to participate in education and an active social life. While the technology solution is important, what makes it truly impactful and sustainable is the work done to coordinate and build the knowledge and skills of professionals who support children and parents to use AAC solutions as a part of early childhood intervention (ECI).

AAC technology specifically and assistive technology devices in general are enabled by a programme of intersectoral development and family-centred support that empowers professionals to collaborate with children, their families, teachers and communities. In the pilot countries, training and learning opportunities were not generally available.

> "The selection of a particular AAC system for a specific child is best made through a collaborative team decision-making process. The team actively involves family members and typically includes teachers, child care providers, administrators, AAC technicians, physicians, and speech and language, occupational, and physical therapists."
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> Mary Frances Hanline, Débora Nunes and M. Brandy Worthy, 'Augmentative and Alternative Communication in the Early Childhood Years', *Young Children*, July 2007

To help fill this gap, a first round of training was provided to more than 127 professionals in 2019 and 2020. Participants included preschool teachers, speech and language therapists, psychologists, occupational therapists and special educators. This training was designed to enhance the professionals' capacities in identifying and supporting young children who have difficulties related to speech, language and communication and could benefit from assistive technology. Feedback from participants in Croatia indicates that:

- More than 80% found the training package to be relevant and the training delivery of high quality;

- More than 90% found that topics were interesting and useful for their professional and practical work;

- 83% observed that the use of online training materials enabled them to acquire new knowledge and upgrade their existing knowledge and skills;

- 74% believed that after participating in this training they were ready to transfer their newly acquired knowledge and skills; and

- 84% felt they would be able to motivate other colleagues to access and learn from online training.

During a second round of training, in 2020, 710 professionals participated in webinars organized in Croatia and Serbia. To expand the number of professionals familiarized with AAC approaches, these online sessions were open to practitioners from neighbouring countries, including Bosnia and Herzegovina, Montenegro, North Macedonia and Bulgaria. In Bulgaria, 47 professionals received training in 2021 – another 100 professionals in North Macedonia and 300 in Bulgaria are scheduled to receive training in 2022.

A robust training package developed by Global Symbols in partnership with UNICEF combines face-to-face and online learning and is available to support professionals from other countries.[9] Along with content on AAC principles and methods for supporting children with AAC technologies, the training package highlights the importance of building the relationship between family and practitioners, and how to work with families and other vital stakeholders in children's lives, in order to achieve successful AAC outcomes. Participants indicated a 65% increase in knowledge and skills after the initial training, and excitingly, the universities of Zagreb and Belgrade are incorporating the training packages into their pre-service training modules for ECI professionals.

Parents and education professionals are also being supported in applying routine-based interventions that integrate the communicator into the child's environment, mainly at home and in preschool. The child's goals are identified together with the family, and support is then provided to integrate technologies into everyday situations to help prepare the child for inclusion in society.

Because parents and teachers are often unfamiliar with AAC technologies, integrated professional support is a crucial part of the initiative. Understanding

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the importance of augmentative and alternative communication, how to use Cboard or other open-source solutions, and making it 'their own' are all encouraged. For example, to personalize Cboard for their home environment, parents have added photos of family members and common objects to the communicator, making it more familiar to the child and easier to understand. When this approach is taken, it enables children and their families to be supported in the adoption and use of a range of technologies based on the child's needs and to take advantage of new technologies as they are developed.

Building capacities to co-create symbol sets

A crucial feature of this approach is the process of developing contextualized symbol sets that reflect the local language and culture. The symbol sets are made affordable and accessible for country teams through free access to the Global Symbols database of more than 20,000 symbols,[10] which are stored in the Global Symbols repository and provided under an open licence to support future projects. Through this, the project countries in Europe and Central Asia were able to select, customize and confirm individual symbols for inclusion in the open symbol set.

The symbols sets, which can be used on the Cboard, are co-created with an expert team to ensure they are adapted to the language, culture and context that will aid children in their specific environments. The text-to-speech function, which is refined in a parallel process, reads out the words displayed on the visual boards, giving children with complex communication needs a voice. In low-tech settings,

the pictographic symbol sets can be exported and printed to support communication work with children using paper-based resources.

Along with the open-source software provided through the web and the Android app, this initiative offers a training package on how to use assistive technologies for early identification and intervention for children with developmental difficulties. Professionals work closely with children and their families to customize boards and to practise using the tool with the child, towards the mutual goal of making everyday life smoother, more interactive and more inclusive.

In ongoing developments, an online and face-to-face training programme for ECI professionals has been implemented for three levels of knowledge and skills, with the potential for replication tailored to additional countries. The open AAC project and its integrated approach to assisting children with complex communication needs is also being formalized through the development of a deployment package and training manual to help more countries easily come on board.

Measuring impact

The overarching goal of this approach to providing flexible, affordable AAC support through ECI systems is to improve children's lives by making it easier for them to communicate. Its impact on children and their families is measured with an adapted form of the Psychosocial Impact of Assistive Devices Scale (PIADS).[11] This self-report questionnaire was designed by Hy I. Day and Jeffrey Jutai, in 1996, to assess an assistive device's effects on 'functional independence, well-being, and quality of life'. Since then, PIADS has been continuously used in professional and academic settings and updated for contemporary contexts.

For the project in Europe and Central Asia, the 26-item questionnaire employed a five-point 'smiley face' Likert-scale and short phrases to assess the app users' progress in three subscales, referred to as 'domains' for Cboard: competence, adaptability and self-esteem. The questions were translated into Croatian, Montenegrin and Serbian and made available as an online tool integrated into Android tablets.

Data were collected in two phases, after three and after six months of use. For each child, the adapted PIADS questionnaire was completed by the parent and by the key professionals working with the

> "I want her to be happy. I want her to love and to be loved. I want her to be safe and secure. I want her to be accepted for who she is. I want her to dream big and know the thrill and the satisfaction of accomplishments that come from hard work. I want her to have the courage to try and sometimes fail. At the end of the day, I want her to know that she left the world a little bit better than when she started out. (A parent talking about her goals for her child, a preschooler who uses AAC)."
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> Janice Light and David McNaughton, 'Designing AAC Research and Intervention to Improve Outcomes for Individuals with Complex Communication Needs', *Augmentative and Alternative Communication*, vol. 31, no. 2, 2015

child. The survey results indicate a high degree of achievement at all levels of competency, self-esteem and adaptability.

During the initial pilot phase of this programme, a sample set of data were collected to measure the app's effectiveness. The results showed that 124 children with complex communication difficulties in Croatia, Montenegro and Serbia benefited from the open AAC approach (using the Cboard app provided on Android tablets donated by UNICEF and the support provided by trained professionals). Bulgaria and North Macedonia, meanwhile, will conduct the Cboard development/customization phase of the programme, and when professionals complete their training they will move into working directly with children. In the region there are currently more than 1,275 children using the Cboard app.

Parents and professionals reported a positive response among children who have effectively integrated Cboard into their daily lives during the first phase of the pilot. Professionals reported that the children responded particularly well to the text-to-speech function, whereby each pictogram pressed 'speaks' the label out loud in the local language. This led to reports of improved confidence and vocalization in children who are primarily non-verbal.

Challenges reported are centred on difficulties with adapting to new technology and a learning curve for parents unfamiliar with the AAC-based communication: For more than half the children and

families, Cboard is the first digital communicator they have used.

As reflected in the PIADS survey, however, progress was reported across the sample of children engaged with the project, in all but one case. For such progress to be made within six months of engaging with the project is a remarkable accomplishment. This outcome reflects the intense and thorough planning and consideration undertaken by UNICEF in partnership with national teams to identify and mitigate potential barriers.

The impact of using the Cboard app with pictographic symbols on an Android tablet with kindergarten and primary-school-age children was overwhelmingly positive. This suggests that the integrated approach to introducing and enhancing AAC has been effective throughout the study period. An environment within which the interventions can be nurtured and succeed appears to have been stimulated by such factors as:

- The engagement of stakeholders in the design and selection of symbols and vocabulary;
- A blended approach to training for both professionals and parents; and
- The motivation of new technology and ongoing support appear.

What is unique about UNICEF's approach to this work?

An app alone would not generate the positive results seen from the Cboard project: Its achievements were founded on continuously evolving strategies for multi-level coordination, continuous strengthening of enabling environments, smart partnerships, and world-class open licence technology.

In the Regional Office and Country Offices, UNICEF in Europe and Central Asia is distinctively placed to convene experts across diverse fields, catalysing change that reaches some of the hardest-to-reach children. 'For every child, a voice' has built its impact through partnerships between UNICEF, government ministries, tertiary education institutions, non-governmental organizations, organizations of persons with disabilities, and innovators in the private sector.

The flexibility for countries to apply this model to different settings and priorities is also an essential element. In **Bulgaria**, for example, there is a focus on using Cboard within education systems – and on using education systems as a support structure

> Natasa Sreckovic Milenkovic, a speech therapist working with Srna, age 3, in Belgrade, Serbia, observed that Cboard positively impacted the child's speech development: "Srna was non-verbal and began to speak after we used the Cboard app [on a tablet]. We set icons for YES, BRAVO, MORE, and after using the Cboard, Srna began to spontaneously use those words in communication when she wanted something. Now, when she does something right, she taps herself and says 'BRAVO' verbally. In communication, she has increased the number of words she utters, some as initial syllables, others as whole words, so she is now working on expanding her vocabulary."
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> UNICEF ECARO, 'Giving Every Child a Voice with AAC Technology', UNICEF Office of Innovation, 23 July 2020

for developing and delivering augmentative and alternative communication technology and services.

Bulgaria's regional centres for the support of the process of inclusive education are sustainable structures within the education system and are mandated to support both teachers and parents. UNICEF has engaged the regional centres as key partners in the AAC initiative, and these centres are supporting the national roll-out of ECI and AAC provisions across the learning continuum.

In **North Macedonia** the AAC training modules and use of Cboard are being embedded within the country's system of professional development as part of compulsory training for staff at the general inclusion support hubs and for education assistants. This will ensure nationwide use and sustainability beyond the project's duration. Linked through EDUINO, a national web portal for digital education content, coordination and professional development,[12] the AAC training modules will also be part of the courses offered to teachers and other education professionals at all levels.

Globally there are now more than 9,000 users on the open source, free Cboard app. Furthermore, the UNICEF Information and Communication Technology Division and the Office of Innovation are developing a business model and scale-up road map to increase accessibility and uptake of the Cboard app globally – and UNICEF headquarters is exploring additional uses for the technology to support children with a range of communication needs.

Concluding reflections:

- The initial Cboard projects in Europe and Central Asia indicate that the engagement of stakeholders in the design and selection of symbols and vocabulary, a blended approach to training for both professionals and parents, and the motivation of new technology and ongoing support have stimulated an environment within which the interventions can be nurtured and flourish.

- The results of monitoring surveys and other feedback from parents and professionals indicate that the use of open resources is a cost-effective model of intervention. This model produced significant results across the cohort of children in Croatia, Montenegro and Serbia – and it is now being implemented in Bulgaria and North Macedonia.

- Introducing augmentative and alternative communication to young children is welcomed by parents, and no negative effects such as further delays in speech were identified. On the contrary, progress was noted in all children as reflected through the PIADS questionnaire. While early intervention produces the most significant results, intervention when the child is older is also effective.

- The use of augmentative and alternative communication in the child's everyday environments, including home and school, supports the greatest impact. The role of parents and teachers in implementing an AAC system should be recognized and should continue to provide the foundation for interventions.

The Cboard project model as identified, developed and carried out in Europe and Central Asia has already generated a process and resources that are highly suitable for replication in many other countries and communities that are seeking to introduce augmentative and alternative communication to children. With an ongoing focus on supporting the parents and professionals who are in close contact with the child – and further development of resources for early intervention among the hardest-to-reach children – the cumulative benefits will be reinforced, giving ever more children a voice and an opportunity for significant participation in the world around them.

Endnotes

[1] Hanline, Mary Frances, Débora Nunes and M. Brandy Worthy, 'Augmentative and Alternative Communication in the Early Childhood Years', *Young Children*, July 2007, p. 1, <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.604.8317&rep=rep1&type=pdf>, accessed 21 December 2021.

[2] *See, for example:* Schladant, Michelle, and Monica Dowling, 'Parent Perspectives on Augmentative and Alternative Communication Integration for Children with Fragile X Syndrome: It starts in the home', 2020, p. 3, <www.aaidd.org/docs/default-source/default-document-library/schladant.pdf?sfvrsn=4a8e3621_0>, accessed 26 December 2021.

[3] Jovic, Aleksandra, et al., UNICEF ECARO, 'Giving Every Child a Voice with AAC Technology: Open source mobile app Cboard will support young children with complex communication needs', UNICEF Office of Innovation, 23 July 2020, <www.unicef.org/innovation/stories/giving-every-child-voice-aac-technology>, accessed 26 December 2020.

[4] United Nations, Convention on the Rights of Persons with Disabilities, A/RES/61/106, 24 January 2007, <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N06/500/79/PDF/N0650079.pdf?OpenElement>, accessed 14 December 2021.

[5] *For basic information on the International Classification, see*: World Health Organization, 'Towards a Common Language for Functioning, Disability and Health: ICF', WHO/EIP/GPE/CAS/01.3, WHO, Geneva, 2002, <www.who.int/publications/m/item/icf-beginner-s-guide-towards-a-common-language-for-functioning-disability-and-health>, accessed 20 December 2021. *Browse the ICF online, access updates and find related resources at*: WHO, 'International Classification of Functioning, Disability and Health (ICF)', <www.who.int/standards/classifications/international-classification-of-functioning-disability-and-health>, accessed 20 December 2021.

[6] An 'open' licence identifies content that "is free of cost – empowering those lacking in resources. It is also free to reuse, empowering innovators, researchers, educators, entrepreneurs – whoever can think of a use for this knowledge. It enables these people to easily share their own improved versions of the work." (Appropedia, <www.appropedia.org/Open_licenses>, accessed 27 December 2021).

[7] Cboard, 'Communication for Everyone', Córdoba, Argentina, <www.cboard.io>, in English, accessed 22 December 2021. *This site offers the following language options*: Croatian (HRV), French (FRA), German (DEU), Italian (ITA), Serbian (SRB) and Spanish (ESP).

[8] UNICEF Innovation Fund, 'Cireha – Augmentative and Alternative Communication Portfolio', 8 December 2017, <www.unicefinnovationfund.org/broadcast/updates/cireha-augmentative-and-alternative-communication-portfolio>, accessed 28 December 2021.

[9] The training site, developed by Global Symbols in partnership with UNICEF, is available in 12 different languages at <https://training.globalsymbols.com>, accessed 27 December 2021.

[10] The Global Symbols database is available at <https://globalsymbols.com>, accessed 8 January 2022.

[11] *For basic information on PIADS, see*: Day, Hy I., and Jeffrey Jutai, 'PIADS: The Psychosocial Impact of Assistive Devices Scale – Manual', © H. Day & J. Jutai 1996, Version 4.2b, 2003, <http://piads.at/wp-content/uploads/2018/11/PIADS_MANUAL__03b_2.pdf>, accessed 22 December 2021.

[12] EDUINO, <www.eduino.gov.mk>, available in Macedonian and Albanian, accessed 27 December 2021.

Stories of Children:

C-board helps Seid to communicate

The long-awaited first word

C-Board application makes communication easier for children with disabilities

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