Using ICT for Inclusive Education in India

2-Day National Workshop

February 23–24, 2015

India International Centre, New Delhi

Acknowledgements

SAMADHAN gratefully acknowledges the support from UNICEF, in particular Amita Tandon, Education Specialist at UNICEF India, for providing valuable guidance and sharing her experience and expertise. We also thank Natalia Mufel, Education Specialist, UNICEF, for initiating the search for a meaningful learning opportunity for a range of stakeholders, including policymakers, academicians, researchers, education specialists, disability professionals, and parents. The end result has been the enriching two-day workshop on the use of ICT in inclusive education in India.

We are also deeply grateful to C-DAC, Hyderabad, for their continuous support and for sharing some of the many responsibilities that came with organizing a national workshop. The C-DAC team's understanding and willingness to share their considerable expertise is much appreciated. The workshop could not have taken place without their support.

We express our sincere gratitude to the representatives from the government who took time off from their busy schedules to be part of the workshop. We would like to sincerely thank Shri. Awanish Awasthi, Joint Secretary, Department of Disability Affairs; Ministry of Social Justice and empowerment, Smt. Stuti Kacker, former Secretary, Department of Disability Affairs; and Smt. Radha Chauhan, Joint Secretary, Department Of School Education & Literacy, Ministry of Human Resource Development, Government of India.

We remain indebted to our esteemed panel of speakers for sharing valuable insights at the workshop. The presentations you made were enriching, engaging, timely, and instrumental in motivating many who attended the workshop, as the feedback forms suggest. We also gratefully acknowledge the generous support provided by the many NGOs and agencies as well as parents and interested individuals who participated in the workshop.

Last but not the least, we also acknowledge the hard work and efforts of both SAMADHAN and C-DAC staff, who immensely contributed to the success of the workshop. Our appreciation and thanks also goes to the India International Centre (IIC) for their support and for giving a day's complimentary use of the venue and the arrangements.

Table of Contents

Abbreviations

AAC	augmentative and alternative communication
ADIP	Assistance to Disabled Persons (scheme)
AT	assistive technology
BOSS	Bharat Operating System Solutions
C-DAC	Centre for Development of Advanced Computing
CwD	children with disabilities
CwSN	children with special needs
DeitY	Department of Electronics and Information Technology
GUI	graphical user interface
ICT	information and communication technology
IGNOU	Indira Gandhi National Open University
JAWS	Job Access with Speech
MCIT	Ministry of Communications & Information Technology
MOOC	massive open online course
NAD	National Association of the Deaf
NIMH	National Institute of Mental Health
OCR	optical character recognition
PwD	persons with disabilities
R&D	research and development
RCI	Rehabilitation Council of India
SAMADHAN	Society for the Aid of Mentally and Developmentally Handicapped
SEN	special educational needs
SSA	Sarva Shiksha Abhiyan
UD	universal design
UDID	unique disability identification
UDL	universal design for learning
UNICEF	United Nations Children's Fund

Executive Summary

Notwithstanding the government's consistent emphasis on promoting inclusive education in India, there has been little improvement in the participation of children with disabilities (CwD) in formal education environments. Most CwD in India have difficulty in accessing even basic education. In this context, the role that information and communication technologies (ICTs) can play in breaking up traditional access barriers and promoting equal opportunities is increasingly being recognized. The technology revolution has created new learning channels and formats that can enable CwD to access education with ease and effectiveness. Building a strong system of inclusive education in India may, thus, require harnessing the power of ICTs to ensure that all students, irrespective of their impairment, be in schools and learning.

The search for a meaningful platform to bring together the various stakeholders and enable information exchange on the issue prompted Society for the Aid of Mentally and Developmentally Handicapped (SAMADHAN), an NGO working for children with intellectual disabilities, and the Centre for Development of Advanced Computing (C-DAC) to organize a two-day national workshop on "*Using ICT for Inclusive Education in India*" on February 23–24, 2015, at India International Centre, New Delhi. United Nations Children's Fund (UNICEF) partnered with the workshop, which was a follow-up to the UNICEF mandate for conducting a desk analysis on the use of ICT for inclusive education in India.

The workshop brought together stakeholders from concerned government departments, institutions, NGOs, researchers and academicians, IT engineers, special educators, parents, trainee teachers, and volunteers. It provided the participants, totaling over 80, the opportunity to share information and insights about the various ICT applications and aids for children with cognitive and physical disabilities as well as to share experiences of using innovative teaching-learning methodologies.

The discussions drew on the rich and varied experience of the different stakeholders and presented an opportunity for exploring the diverse range of available ICT tools and solutions, details about which are carried under summaries of discussions ahead in this report. Not all discussions were technical in nature though, and the participants were sensitized to the wide range of issues and concerns around inclusion and integration of PwD through enriching personal stories, experiences, and insights.

The workshop thus evolved an improved understanding of the various issues, challenges, and opportunities for using ICTs for inclusive education. It also brought into focus the need for supportive policy framework; use of universal design in educational materials and environments; research and development (R&D) on new ICT solutions and practices; and training and capacity building of special educators, among others.

In a sense, perhaps the biggest achievement of the workshop lay in drawing out the information about available ICTs and practices from different scattered pockets and bringing it together on a common platform to enable learning, ideation, and adoption. The workshop clearly highlighted the need for continued information exchange, dialogue, collaboration, and research into developing affordable and scalable solutions that can allow every child to access education, learn effectively, and realize his or her potential.

Introduction

The need for "inclusion" and integration of children with cognitive and physical disabilities in the school environment has long been emphasized. In fact, inclusive education is an integral component of the Government of India's flagship *Sarva Shiksha Abhiyan* (SSA) program for achieving universalization of elementary education. Notwithstanding this good intent, many of the children with disabilities (CwD) continue to miss out on opportunities for learning and have difficulty in accessing even basic education. Information and communication technologies (ICTs) can play a vital role in dismantling the traditional access barriers and promote equal opportunities to education. The rapid growth and expansion of ICTs is creating new learning channels and formats that can enable children with disabilities to access education with ease and effectiveness. In India, which has made impressive strides in ICT but where only a fraction of the disabled population has access to education, the need for addressing this issue is both apparent and urgent.

Aiming to define the scope of ICTs for inclusive education and explore the various ICT applications and aids for children with cognitive and physical disabilities, Society for the Aid of Mentally and Developmentally Handicapped (SAMADHAN), an NGO working for children with intellectual disabilities, and the Centre for Development of Advanced Computing (C-DAC), organized a two-day national workshop on "*Using ICT for Inclusive Education in India*" on February 23–24, 2015, at India International Centre, New Delhi. United Nations Children's Fund (UNICEF) partnered with the workshop, which was a follow-up to the UNICEF mandate for conducting a desk analysis on the use of ICT for inclusive education in India.

The workshop aimed to provide the participating organizations and delegates the opportunity to discuss, deliberate, and display the various educational and assistive technologies (ATs) and tools as well as to share experiences of using innovative teaching-learning methodologies. Stakeholders from the concerned government bodies, national institutions, NGOs, researchers and academicians, IT solution providers, advocates, special educators, parents, trainee teachers, and volunteers took part in the workshop, which brought together over 80 participants over the course of the two days.

Brief introduction to the workshop organizers:

- **SAMADHAN**, a registered non-profit organization set up in 1981 in New Delhi, India, works with children with intellectual disabilities and their mothers. Operating through its two centers, in Dakshinpuri and Dwarka in New Delhi, the organization has put in place innovative service models to effectively support the lower socio-economic community it focuses on and provide community outreach for raising awareness on intellectual disability, advocacy in local mainstream schools, therapy, special education, and early intervention.

- **C-DAC** is the premier R&D organization of the Department of Electronics and Information Technology (DeitY), Ministry of Communications & Information Technology (MCIT), Government of India. Set up in 1988, C-DAC carries out R&D in IT, electronics, and associated areas, building capacities in emerging/enabling technologies and developing and deploying innovative IT products and solutions for different sectors.
- **UNICEF** is a United Nations program that provides developmental assistance to children and mothers in developing countries. Working in India since 1949, UNICEF is the largest UN organization in the country. It is committed to working with the Government of India to ensure that every child born in the country gets the best start in life and the opportunity to grow and develop to his or her full potential.

The workshop conveners were Sumathi Morgan, Programme Consultant, SAMADHAN, and M. Kumar, Senior Technical Officer, C-DAC.

This report is the outcome of the two-day workshop and aims to present some key points that emerged in the discussions over the course of the workshop.

Objectives of the Workshop

The key **objectives** of the workshop were to:

- Sensitize the various stakeholders, particularly the ICT research community, about the key issues, challenges, and possible solutions aimed at different disabilities, like visual and hearing impairment, locomotor disability, autism, spasticity, and intellectual disability
- Provide a common platform for the various stakeholders, like parents, special educators, researchers and scientists, IT solutions developers, domain experts from national institutes, and NGOs, to enable exchange of research ideas, experiences, and possible solutions

The main **goals and outcomes** of the workshop were to:

- Expose academicians and researchers to various research challenges and encourage them to take up R&D work for developing applications and aids for persons with disabilities
- Educate stakeholders on why and how information tools are used in inclusive educational set-ups
- Develop a better understanding of the benefits and challenges in implementation of ICTs in line with the school curriculum
- Provide a platform to discuss the importance of teacher training and support in ICT, classroom management techniques, and positive involvement of school leadership
- Explore the open educational and digitized resources available for use in inclusive educational set-ups, including ICT-related hardware and software
- Brainstorm on the available innovative techniques/materials and creative activity-based learning for children with disabilities
- Share the experiential work being done in India

Workshop Inauguration

Inaugural address

The workshop on "*Using ICT for Inclusive Education in India*" began with a brief inaugural address by Pramila Balasundaram, the Founder-Director of SAMADHAN. Balasundaram greeted and thanked the gathering of participants for their interest and enthusiasm. She welcomed the dignitaries on the dais — Chief Guest Awanish Kumar Awasthi, Joint Secretary, Department of Disability Affairs, Government of India; Amita Tandon, Education Specialist, UNICEF; Mita Gupta, UNICEF; and Dr. E. Magesh, Director, C-DAC, Hyderabad. Continuing the tradition at SAMADHAN to recognize the presence of persons with disability and thus acknowledge their personhood, Balasundaram invited Aman, a young person with disability, to light the lamp with the other dignitaries and say a few words.

Aman's brief but personal speech set the tone for the workshop. He shared with the audience how with the right support, self-belief, determination, and hard work, he had succeeded in converting his disability into ability and overcome many of the difficulties life had presented him with. Today a successful entrepreneur, Aman holds a Master's in Geography from the prestigious Delhi School of Economics, apart from several other academic and co-curricular achievements. Aman ended his address by sharing a few inspirational lines he had read somewhere:

"Zindagi ki asli udaan abhi baaqui hai,
Aage kai imtihaan abhi baaqui hain.
Abhi to naapi hai mutthi bhar zameen,
Aage poora aasman abhi baaqui hai."

(The true flight of my life is yet to commence,
There are many challenges I am yet to face.
So far I have navigated only a bit of the earth,
The whole sky before me I am yet to traverse.)

Address by the Chief Guest

The chief guest at the workshop, Awanish Kumar Awasthi, Joint Secretary, Department of Disability Affairs, Government of India, gave the inaugural address. Awasthi has been at the department since its inception in 2013 and is driving effort towards the finalization of the new disability law that is envisioned to make a great difference in the lives of people with disability; the bill is currently under consideration in the Rajya Sabha.

Beginning his presentation on the initiatives of the department for persons with disabilities (PwD), Awasthi provided an overview of the current scenario. According to the 2011 Census, the country has about 2.68 crore PwD, or about 3 percent of the population. Acknowledging that there are estimates that peg the numbers much higher, Awasthi noted the issues that currently hinder identification of PwD and may cause underreporting, such as poor reporting by older PwD, stigma, and lack of training of the census staff.

Awasthi stated that the biggest challenge lay in identifying a person as a person with disability. Currently, PwD are identified through the disability certificate, issued by the office of the Chief Medical Officer in each district; the process is not only slow and difficult but also results in malpractices. Only about 45 percent of the country's PwD have a disability certificate. Given this situation, the department has initiated work on developing a universal ID for all PwD through the unique disability identification (UDID) system.

The UDID initiative seeks to address issues of data management, create a national database of PwD, and issue a UDID card to every person having a disability. Riding on advanced IT systems, UDID will create a centralized, standardized, web-based National Disability Database with authorized access to states. It would leverage the Aadhaar platform for online authentication using the biometrics of the beneficiaries. The smart card would also have data like personal details, type of disability, educational qualifications, employment details, and bank account number of the PwD. UDID would greatly enhance convenience for PwD as the card will be a single document for identification and verification of the disabled to avail various benefits.

Moving on to the department's other ICT-linked initiatives, Awasthi shared details of the Swavlamban web portal (http://swavlamban.info) that provides comprehensive information about the assistive aids and appliances available in India; distribution of touch screen tablets to

visually impaired persons; and R&D on technological advances like brain computer interface, neuro-headsets, integrated wheel chair, 3-D printing, and the use of space technology for developing aids for PwD. Concluding his address, Awasthi invited suggestions and sought support from the people working in the domain to help the department formulate and take forward its initiatives for PwD.

Questions from the audience:

Question 1: *What can be done on the job front for persons with disabilities?*

Answer: *Three percent reservation has been made in government jobs for persons with disabilities. The recruitment process involves a written test and interview. Our effort is towards getting government departments to take persons with disabilities into jobs. In fact, the railway has agreed to take blind persons into jobs it did not take before. People are getting aware and, although we are still able to fill only about 1 percent (of the 3 percent) positions, efforts are geared towards improvement on this front. There will soon be a job portal where people can log in and, based on their educational qualifications, explore jobs, including with the private sector. The department is also planning to ramp up trainings going forward.*

Question 2*: Please throw light on how the UDID is linked to Aadhaar.*

Answer: *Through the Aadhaar initiative, almost about 70–75 crore persons have already been identified through a biometric mechanism. So we do not need to repeat the whole exercise. However, Aadhaar did not capture details of disability, and the disability certificates to have not been put on IT systems. We will put it all together so that government departments can easily access the information. We will have to take a call on how much of this information can be put in the public domain as there are divergent views on this issue.*

Question 3: *Does one need to carry the card?*

Answer: *Although the smart card will carry all the information, even if a person remembers his/her UDID number, their information can be accessed and verified. It will take us at least one year to complete the whole process and make the card available. Once this is done, it will help on many fronts, including identifying people for benefits and jobs. The universal ID will also lead to early registration of children, enabling early identification and treatment.*

Question 4: *Kindly shed some light on how much the other ministries are on board with your department's initiatives. For example, although you are giving assistive devices and the Sarva Shiksha Abhiyan (SSA) is also giving schools INR 3,000 per disabled child, but how much are they reaching. If the children can actually have these tablets and assistive devices, it would be a breakthrough as we can reach out to the children with a lot of learning material.*

Answer: *This is an important point. We will be in constant touch with the Health department, the nodal agency for getting the disability certificate, and the education and HRD departments. The onus would be on the state and district authorities as that is where the challenge lies. The other challenge is of resources; how much funds would be made available to us to make these devices available. My estimate is that in this country we need aids and assistive devices to the tune of INR 2,000 crore. We are way behind on this count. Although government can do its bit, private sector through CSR, other agencies, and NGOs will have to come forward.*

Address by Dr. E. Magesh, Director, C-DAC, Hyderabad

Dr. E. Magesh, Director, C-DAC, Hyderabad, welcomed everyone present on behalf of C-DAC and SAMADHAN. Briefly detailing the work of C-DAC as a premier scientific society, Dr. Magesh spoke of the genesis of C-DAC, its different centers across the country, and the work it does on thematic areas like high performance computing, language technology, and professional electronics. He spoke of the work C-DAC has been doing in the area of assistive aids and devices, like hearing aids and laser stick for the blind. C-DAC has also been working with the National Institute of Mental Health (NIMH) and has developed the assessment tool e-Saadhya and a learning management platform to train trainers.

Dr. Magesh expressed hope that the workshop would help C-DAC understand how it can collaborate with NGOs and special educators who know more about the on-the-field requirements, and combine this knowledge with technology to address the needs of PwD.

Summary of Discussions

Day 1: February 23, 2015

Session 1

The session was chaired by Stuti Kacker, former Secretary, Department of Disability Affairs, Government of India. Kacker brought to the discussions her knowledge and rich experience in the area.

1. Desk Analysis – A Report: *Kartik Sankar, SAMADHAN*

Kartik Sankar presented findings from his desk analysis on the use of ICT in inclusive education in India. The research was undertaken by him on behalf of SAMADHAN, as mandated by UNICEF. Sankar began by providing an overview of the information sources, the various challenges in collecting information and conducting research, and the methodology employed. The research showed that although ICT is being used in inclusive educational set-ups, questions remain about how much the ICT-enhanced learning really works and enables students with disabilities to integrate better in schools and participate in the learning environment. Sankar emphasized the need for further exploration of these questions.

In terms of the actionable insights, the desk review pointed to the need for more accessibility and customization features in ICT solutions; exploring the use of new technologies like cloud computing and touch screen; creating an overall positive environment for leveraging ICTs; removing attitudinal barriers to the use of technology; supporting educators in using ICTs; and monitoring ICT implementation. At the policy level, although the desk review commended the government's positive stance on the issue of inclusion, it showed that ICT implementation was not part of policy framework at the school level. The desk review further highlighted the need for setting up an access technology research center at the national level, a role that C-DAC is playing to some extent; enhancing collaboration for R&D and with

private corporates, especially for tapping technology resources; and leveraging the social media for greater advocacy on the issue.

Sankar concluded by invoking people's sense of responsibility to ensure that every child is able to make the best possible life for himself/herself through access to learning and use of technology. He believed that the present workshop was a step in that direction.

Questions from the audience:

Question 1: *From the private schools' side, although classes are already being equipped with technology like wi-fi and smart boards, there is lack of clarity on what more could be done for children with disabilities. What in specific can be done for CwD?*

Answer: *There are a lot of ICT solutions, like content and access technologies, but one has to ascertain what is compatible and what needs tweaking to match a child's specific needs. "Children with disabilities" is an umbrella term that includes children with many different disabilities. The specific needs of children must be addressed with suitable interventions. For example, the needs of visually impaired children are different from that of children who are intellectually impaired. Responding to specific needs would require different technologies, curricular modifications, and training the teachers accordingly. Different schools have developed their own models, which must be examined and best practices adopted.*

The two-day workshop is an attempt to break ground in this area. We are looking for solutions and practices, and the desk review and the workshop are seeking to capture these practices. Representatives from technology side and schools are here to explore what to do and how to do.

Question 2: *Affordability and accessibility of technology come into question when the issue of scaling up comes up. The other issue is of ensuring accessibility in different languages, as well as making the language of technology easy to understand. Further, there is the issue of setting up inclusive education resource centers, which are of critical relevance for government schools.*

Answer: *These are key points and will be deliberated in this workshop. The planned discussions over the course of the workshop will focus on these issues.*

Question 3: *One big area of difficulty the educators find is of assessment, for example, when the children have to give CBSE examination. A child may be good at keyboarding skills like touch and learn but that option is not available for assessing these children. The solution must not look at education alone but the assessment aspect also.*

Answer: *When we say education, it is not a process that stops at the school gates. We have to change our way of thinking and see it as a lifelong support system that we must develop.*

2. Universal Design and Accessibility: *Amita Tandon, Education Specialist, UNICEF*

Amita Tandon, Education Specialist, UNICEF, began her address by reiterating the goal of the workshop — to show the way forward on what to do and how to do in the use of ICT to promote inclusive education in India. She emphasized on the need to bring together the knowledge that currently exists in pockets onto one platform. Speaking of the current focus on right to education (RTE), Tandon acknowledged the progress that had been made in terms of enrollments, budgetary allocations, and infrastructure, but wondered how much the question of accessibility had truly been addressed.

Quoting some key figures, Tandon mentioned that of the six million children who were out of school in India, one-thirds were CwD, according to government figures. Even for the children in school, the level of learning was low, as shown by the recent National Achievement Survey results, which showed that 50 percent children could not read or write and 42 percent could not do math. The need, Tandon emphasized, was to look at grassroots reality and devise solutions that can help reach out to all the children, optimize learning, and actualize their potential, be they children in hi-tech schools or in resource-constrained public schools.

Tandon shared that the current thought at both national and international level, albeit at a nascent stage, is to explore the use of universal design (UD) to improve every child's access to learning. Highlighting the crucial role UD can play in improving accessibility, she underlined the need to design the educational environment, be it infrastructure, software, or educational content, so that learning is truly accessible to all children. In terms of UD educational material, one idea Tandon mentioned was to design the school textbooks in UD. Currently, educational materials are available in a 'one size fits all' mode, ignoring the special needs of children with disabilities. Even when the content is digitized, it is put up as scans on website, which a visually impaired child, for example, cannot access. Further, the special educators are not trained to deal with different disabilities.

Elaborating on the concept of UD, Tandon discussed the possible formats like e-pub and inclusion of auditory and sign language inputs that could be integrated in digitized learning material to improve access. These digital formats are not only cost-effective but can also help normal children as well; for example, a child who is an auditory learner would benefit from such material. Tandon highlighted UD as a promising area that was witnessing innovation, like the Daisy consortium and

the pilots in IITs. The need, she emphasized, is to identify and gather the knowledge scattered in different pockets of excellence and integrate it to design affordable solutions that can be scaled up.

Questions from the audience:

Question 1: *Given that a significant number of children come from economically weaker sections, what can be done to make UD material available to these children after school, for use at home? How can the affordability aspect be addressed?*

Answer: *Assistive technology is currently expensive, and there is a need to design cheaper solutions. The area is still exploratory, but one approach that is being looked at is the use of mobile phone technology.*

Further, facilities for eligible children can be availed under SSA or through the government's Assistance to Disabled Persons (ADIP) scheme. Other approaches could be setting up community solutions (resource centers), giving the children extra time at schools, and using the buddy system.

3. ICT and Mobile Technologies for Inclusive Education: *M. Kumar, Senior Technical Officer, C-DAC*

M. Kumar, Senior Technical Officer, C-DAC, presented on the cutting-edge work being undertaken at C-DAC in a range of technology areas, including the development of assistive aids and devices. Speaking of the need for inclusive education, Kumar listed the barriers that currently hinder inclusion in the learning environment; these barriers include non-availability of inclusive educational facilities, poor availability of affordable and accessible technologies customized to local needs, and lack of awareness and

community support. The implementation of ICT for inclusive learning, Kumar stated, was also not without its challenges, which included the bandwidth requirement, low desktop penetration, and poor adaptability and availability of e-content on mobile phones.

Kumar made a strong case for using the ubiquitous mobile phones to promote more equitable access to education. He pointed out mobile phones' various features that were useful for inclusive education, like voice recording, screen reading, optical character recognition (OCR), digital pens for making notes, and speech synthesizing. Specific mobile applications (apps) could also be developed to aid accessible learning, such as for video streaming (m-streaming) of lectures, apps for accessing audio resources, voice recording, file sharing, mobile phone-based assessment (m-assessment), and UD packaging of learning content. Kumar stressed on localization of apps and content to meet local needs in India, especially by improving the availability of content in different Indian languages, and ensuring adherence to the W3C guidelines to make websites and applications accessible to PwD on the mobile phone.

Speaking of C-DAC's work in inclusive education, Kumar elaborated on the mobile phone app developed under SSA for the use of teachers; the app enables teachers to assess the child on the spot by using a mobile phone and helps identify the next course of action. Kumar concluded his address by listing the different assistive aids and devices developed by C-DAC: Tarang — a digital programmable hearing device; Braille Mozhy — a document editor for Malayalam text using Braille keyboard with voice support; Acoustic Torch — a personal navigation tool for the visually challenged; Vartha Mozhy — a newspaper reading system; and a personal tutoring system for the hearing impaired, among others.

Questions from the audience:

Question 1: *Given that mobile phones are not allowed in most schools, how do schools take up the mobile apps for learning?*
Answer: *At the school level, mobile-based learning is currently being positioned for use at home, as an out-of-school learning transaction. It must be seen as an add-on to classroom education.*

Question 2: *Is social media being used to circulate the solutions? Which format have the apps been developed in?*
Answer*: The content must be freely shared for it to be truly accessible. So, the solutions must use social media sites and be developed in free, open source technologies, for example using cloud infrastructure. C-DAC is doing that.*
On the second issue, the apps were initially developed for the Java platform but given the increasing penetration of the Android platform, C-DAC is now developing all its apps in Indian languages for the Android format to target the masses.

Concluding remarks for Session 1

Session 1 concluded with a brief address by Radha Chouhan, Joint Secretary, Department of School Education and Literacy, Ministry of Human Resource Development. The discussions at the workshop, Chouhan commented, were critical to the work on inclusion of children with special needs (CwSN). She pointed to the scenario on the ground, where dropout rates are high in secondary classes and the teachers, already under pressure from handling multi-grade classes, lack the capacity to attend to CwSN.

Speaking of the way forward based on the learning that was emerging, Chouhan identified teacher-training institutes as the first point of intervention; these would allow teachers to use the new technologies, such as those developed by C-DAC. Secondly, NCERT and C-DAC could adapt to the needs of CwSN the books that were already available in e-book format in the national repository of open resources. These could be immediately deployed at the 82,000 schools that are already equipped with ICT infrastructure. Thirdly, there could be a bouquet of ready-to-use free basic mobile apps that can be translated in local languages and shared with states for use at least with elementary schools.

Session 2

The session was chaired by Amita Tandon, Education Specialist, UNICEF, who brought in her experience and expertise to guide the discussions.

4. User Experiences: *Representatives of Step by Step School*

The second session began with a presentation by Gauri Rao and Eishwinder Juneja, representatives of Step by Step, an inclusive, integrated school that has a separate department for special educational needs (SEN) children. The speakers discussed in detail the systems and solutions in place at their school to attend to SEN children.

The school's SEN department is divided into two parts — the Centre for Special Education (CSE), where special educators offers SEN children therapy and support, including use of ICT, as required, and the Remedial Department, where full learning support educators work with the integrated mainstream class. Depending on their cognitive level, the children in CSE are further divided into two groups — adapted academic group, with children having the capability to do

mainstream or similar academic course, and the functional group, with children whose cognitive ability hinders them from being academically sound. The children are thus given attention in response to their specific needs.

Further, the ICT curriculum has been devised to make it age/grade-appropriate. For example, the ICT interventions for a child in early education years (6–8 years) focus on skills like eye-hand coordination and mouse, keyboard, and touchscreen skills. The educators take the initiative of, for example, creating games in Google scratch or identifying free online games and placing them in a Chrome toolbar for the children to play and learn. For older children (primary education; 9–11 years), the ICT focus is on file management, introduction to word processing and paint, logical thinking, and comprehension and reading skills. SEN children in both categories are exposed to activities like word, color, and memory games. The school also makes touchscreens available in the ICT lab, for use by children with motor disabilities who cannot use the mouse. Further, it makes CBSE and NIOS curriculum available to the SEN children; in fact three SEN children from the school have appeared for NIOS. Depending on the curriculum chosen, the SEN children (12–16 years) are given ICT education encompassing, among others, computer basics and application software like Word, PPT, and Excel.

Not all SEN children are, however, able to take the board-level examinations, and there is a critical need to prepare these children for an independent life later. To this end, the Step by Step school makes efforts to equip the SEN children (12–16 years) with pre-vocational skills like reading and comprehension, use of external devices like printer and memory cards, file management, computer hardware, and communication apps like e-mail and Google Talk. The children are also taught life skills like online banking, online bill payment, online railway routes and ticket bookings. With children having motor disabilities, who have difficultly in using computer mouse and keyboard, access technologies like Ease of Access in Windows 7 are used. For students with speech difficulties, the school uses alternative and augmentative communication (AAC) technologies, and is procuring and customizing software like TapToTalk and Avaz India.

The presenters concluded by stating that the school was always on the lookout for more technology solutions and software that can make learning effective for children with disabilities. They hoped the workshop would expose them to new innovations in the field.

Questions from the audience:

Question 1: *What is the level of interaction between SEN children and normal children at your school?*

Answer: *Step by Step is an integrated, inclusive set-up. All the children are integrated in co-curricular activities, take dance and drama classes together, and attend the assembly together. The remedial classes have both SEN and mainstream students. The school runs a sensitization program to sensitize the mainstream children to be empathetic to SEN children, using play and the buddy system.*

Question 2*: How many special educators are there in the school?*

Answer: *The school has a total of 50 special educators, 25 of which are in the CSE department and 25 in the mainstream remedial classes. The school has 100 SEN children.*

Question 3*: The school is doing commendable work, but how are these facilities financed, especially with regard to lower socio-economic classes? This would be critical from the point of view of affordability and scalability.*

Answer*: The school charges an extra fee from SEN students, but there is some kind of fee waiver for some students.*

The session chair, Amita Tandon, recognized the exemplary work the school is doing. Acknowledging that affordability and scalability of such practices was a major issue, she stated that these best practices should nonetheless be examined and leveraged not only in public schools but also other private set-ups.

5. Designing Inclusive Classrooms – ICT Complementing UDL: *Prof. Amitav Mishra, Director, School of Special Education, IGNOU*

Using an illustrative and engaging presentation, Prof. Amitav Mishra, Director, School of Special Education, IGNOU, effectively unpacked the concept of universal design for learning (UDL) and how it can be linked with ICT for inclusive education. Prof. Mishra spoke of the need to appreciate and accept differences and diversity in intelligence and abilities, identify the potential that every child has, and allow him/her to access learning through the medium that he/she most prefers. Prof. Mishra pointed out how diversity has already been accepted and adapted to by the industry, which uses UD to cater to the tastes, needs, and pocket of each person. In the field of education as well, there should be no barrier, and teaching methods and curriculum should be responsive to each child's choice and need.

Elaborating further on the imperatives of UDL, Prof. Mishra talked of the need to ensure flexibility in (i) representation –the format in which the learning material/information is presented (through the use of ATs like braille and use of multimedia, like digital, text, visual, auditory, voice overs with PPTs, etc.); (ii) expression – how the children express their learning or the mode of assessment (type of tests – oral or written, which can again be multiple choice or open ended); and (iii) engagement – how the children's interest is ensured and stimulated. Engagement can especially be fostered by using ICTs, like interactive writing, games, videos and podcasts, narrated art and stories, and simulation.

Prof. Mishra gave interesting examples to bring clarity to the concept of UDL. He also provided information about a six-month professional development program, covering UDL and inclusive education, that was being run for Kendriya Vidhyalaya (KV) teachers, and shared success stories from the program. He highlighted that there are a number of choices before educators today, and even low-cost methods and technology like simple photos and drama would work if the teachers innovate.

Questions from the audience:

Question 1: *Can you tell more about the program for KV teachers? Are the modules class-specific or subject-specific? Can they be adapted for the public school system by the Government of India?*

Answer: *Yes, for example, for teaching science, it covers how UD can be applied to teaching of science. Now we are transforming the entire B.Ed. material into inclusion format, with boxes, quizzes, questions. There will be no separate material only for typical children and some other material only for special needs children. We want to combine the material so that there is no discrimination between learners on any basis, be it ability, language, or culture. This will be a completely uniform or UD material for teacher training.*

(Amita Tandon, the session chair, added that these learning materials would be quite useful for teacher training programs. It may be good to share these with MHRD, which is always looking for such training materials for teachers.)

Question 2: *More and more teaching courses are done online. Do you think more teaching should be done in the classroom or online?*

Answer: *There are multiple formats for teaching. Online education allows reaching out to a large number of students. The government is thus encouraging massive open online courses (MOOCs), free short and specific learning courses/materials. Even best practices developed in the classroom can be uploaded and improved.*

6. Findings of ICT Projects for Education of Children: *Revathy Rugmini, Regional Representative - Asia, Leonard Cheshire Disability*

Revathy Rugmini, Regional Representative - Asia, Leonard Cheshire Disability (LCD), began her address by providing a brief overview of LCD and its history. A voluntary body, LCD has been supporting people with disabilities over 65 years. Today the organization is working on a range of areas including economic empowerment, inclusive education, campaigning and advocacy, and research.

Highlighting the need for inclusive education, Rugmini stressed on examining how much the country had been able to translate the UN Convention Article 24 with regard to the rights of CwD and PwD for education. The article covers teacher employment and training, use of augmentative and alternative modes, communication formats, techniques, and materials to support education of persons with disabilities. In this context, Rugmini shared the inclusive education model that LCD had developed, called the Inclusive Education Resource Centre (IERC) model. Technology and tools, like access technologies, are the key focus of the model, which links education with employability.

Elaborating on the model, Rugmini provided details on how the model is operationalized in remote locations where most of the vulnerable and disadvantages community is living. The first step of the IERC model is the identification process, followed by assessment and counseling of the family and the child. Referral

and therapeutic support then come into play; linkages play a critical role here. The focus thereafter is on enrolment and retention, to ensure continuation of education and learning outcomes. IERC is based at government school premises itself, equipping it with basic therapeutic equipment as well as positioning it to serve as a knowledge center.

The schools selected as model centers are made completely accessible, right from the entrance to wash facilities, parks, and classrooms. The children are provided different assistive and access devices like hearing aids and walking frames. In terms of the use of ICTs, augmentative and alternative communication (AAC) solutions are used; these include JAWS (Job Access with Speech), the speech to text Dragon software, NVDA, Voice Stick, Digi Pad to take notes, Avaz, talking library, and tactile books.

Concluding remarks for Session 2

Amita Tandon, Education Specialist, UNICEF, concluded the afternoon session by emphasizing the need to merge all the knowledge that was shared by different participants, be they a private school, national open university, or NGOs. The learning from all these disparate initiatives should be brought together to devise affordable and scalable solutions that can benefit all the children.

Day 2: February 24, 2015

Session 1

SAMADHAN's Pramila Balasundaram, who chaired the session, welcomed all the participants to the second day of the workshop and expressed hope for a day of learning and enrichment.

1. Accessible Computing @ C-DAC: *Leena Chourey, C-DAC*

The second day began with Leena Chourey's presentation on accessible computing and what C-DAC has been doing in this area. Chourey explained how C-DAC recognizes that even the technology solutions that abound in today's digital society are not designed keeping the PwD in mind. For example, the use of graphical user interface (GUI) and keypad and pointer based input mechanisms exclude a large section of society. Challenges also emanate, among others, from the multiplicity of disabilities and their unique requirements, access barriers like language and distance, lack of awareness, lack of skilled accessibility professionals, and multiplicity of technology platforms and devices. Chourey noted the need for increased effort in developing accessibility solutions for the intellectually impaired, as this area has so far been least addressed.

Solution to the multiple challenges, argued Chourey, lay in addressing 'inclusion' in the design stage itself. To this end, C-DAC's focus has been on developing accessible, affordable, and adaptable solutions through robust requirement gathering, working with communities, collaborating with NGOs who work in the area of disability, and generating awareness about the availability of these tools and technologies. Elaborating on the key accessibility solutions designed at C-DAC, Chourey shared details on: ALViC, accessible Linux for visually impaired; predictive writing system Anumaan and gesture-based input mechanism GEM for persons with

physical impairments; GLCC, a GNU/Linux distribution mechanism that creates a more accessible desktop environment for the cognitively challenged; and enhancements and localization of the screen reader Orca to address the needs of the visually impaired in India. Apart from developing these solutions, C-DAC has also been conducting training programs for the disabled on the different computer-based assistive technologies.

Speaking of the road ahead, Chourey highlighted the need for vendor, platform, and device neutrality; uniform/responsive design of applications and solutions; creating an ecosystem involving all stakeholders; and development of smart devices and other platforms like cloud.

Questions from the audience:

Question 1: *Please provide some information about Braille printers?*

Answer: *Once any file is converted into the Braille format, one can take out prints from the Braille printer.*

Question 2: *Does one have to create a database of words for the predictive writing system Anumaan?*

Answer: *A database of words already exists but one can add more words if required. Similarly, for the solution that works based on gestures, many are already there but one can also add more gestures.*

Question 3*: The English accent of the default voice in Orca is difficult to understand. Do you work on Indian languages also?*

Answer: *Other teams are working on the accent, but we have added Indian languages.*

Question 4: *Can you look at including the track change option in the solutions designed for visually impaired persons? Also, can the gestures be aligned with the sign language?*

Answer: *We have not checked these specific requirements yet, but we can work on them if the requirements come.*

2. ICT for Children with Intellectual Disability: *Surekha, Senior Project Engineer, C-DAC*

Surekha, Senior Project Engineer, C-DAC, presented on e-Saadhya, a flagship ICT solution C-DAC has developed for meeting the special needs of children with mild mental retardation and autism. An adaptable and accessible e-learning framework, e-Saadhya caters to the children in primary schools, within the age group of 16 years, in line with the SSA policy.

Detailing e-Saadhya's architecture and modules, Surekha discussed the range of functions that the solution covers for each role — learner, instructor, therapist, and parent. A comprehensive solution, e-Saadhya has modules for child profiling, assessment, decision support, lesson creation, collaboration, and evaluation. Along with English, the solution is also available in Hindi, Kannada, and Telugu. Surekha provided examples of different functions and activities and showed e-Saadhya's simple and engaging child interface. The solution has been deployed in over 20 schools across India, and more are underway.

Presenting on C-DAC's initiatives for CwD, Surekha also provided brief details about the other related ICT solutions developed by C-DAC, like the multilingual awareness web portal (http://learnwithme.cdac.in) on autism and mental retardation and Swar, an assistive aid using which a child can express his/her needs and feelings via a mobile voice by tapping on relevant pictures provided in the app.

Questions from the audience:

Question 1: *How many children can one register with e-Saadhya? Also, how many worksheets can one add?*
Answer: *There is no limitation on the number of children or content that can be added to e-Saadhya.*

Question 2: *When did work on this solution start?*
Answer: *We started the*

development work in 2011, and have consistently been improvising on its features. Currently multilingual enablement is being done. The solution development is now in its final stages.

Question 3: *Is e-Saadhya available free of cost?*
Answer: *Yes. It is an open source tool and is free for people to use.*

Question 4: *Given that not all special educators are computer literate, they may face issues and glitches when using it? What is the provision for that?*
Answer: *Training is the key. C-DAC has undertaken several training programs for educators and caregivers. We conduct regular trainings, also for master trainers so that they can go back to their special schools and train the other educators. C-DAC is also open to organizing more such trainings.*

Concluding remarks for Session 1

Pramila Balasundaram concluded the session by thanking the presenters for exposing the participants to the many ICT solutions that are already available for use.

Session 2

Pramila Balasundaram chaired the session.

3. Punarjjani – A Web-based Tool to Assist Special Teachers in Assessment of Mentally Challenged Children: *Gaurav Takkar, Senior Research Scientist, Media Lab Asia*

Gaurav Takkar, Senior Research Scientist, Media Lab Asia, began his presentation with a brief introduction to the organization and its mission of bringing the benefits of ICTs and other technologies to the common people. Empowerment of persons with disabilities is a core area for Media Lab Asia.

Takkar provided details and gave an illustrative demo of Punarjjani, one of Media Lab Asia's flagship ICT solutions for CwD. Punarjjani is a web-based assessment tool for mentally retarded children of ages 3–18 years. It facilitates the three standard manual tools widely used at present in India, including Functional Assessment Checklist Programming (FACP), Behavioral Assessment Scale for Indian Children with Mental Retardation (BASIC-MR), and Madras Development Programming System (MDPS). The software is capable of generating the required graphs and

charts on the progress of each child based on the input data provided by specialist educators. It facilitates qualitative and quantitative measurement of progress and homogeneous grouping of children. Each child's record is kept confidential. Once hosted on the Internet, data can be accessed by the particular school only through secure authentication. Lesson plans are, however, shared and made available to all teachers. One hundred lesson plans are currently integrated into Punarjjani, and 6,000 more lesson plans are being uploaded in a reference library. Punarjjani has so far been tested at 23 schools on trial basis. Trainings on the tool have been conducted for special education teachers across the country. Work is currently underway on providing the tool in Indian languages and integration of vocational assessment checklist and diagnosis and assessment tools for autism and learning disabilities.

Concluding his presentation, Takkar mentioned the other Media Lab Asia projects in the field of disability. These include the following: Punarbhava, an interactive web portal for disseminating information on different disabilities; Sanyog, an icon-based communication tool for persons with speech and neuro-motor disorders; computerized Braille transcription system; a digital library of e-text, Braille, large print, and audio content; text-to-speech (Shruti) and text-to-Braille (Drishti) special web browsers for the visually impaired; SAFA, a screen reading software; Smart Cane, an ultrasonic ranger and vibrator to provide mobility assistance to the visually impaired; and Navshikhar, an satellite-based television channel to provide interactive programming for the disabled, parents, special educators, and trainee teachers.

Questions from the audience:

Question 1: *Can Punarjjani be integrated with a school's student management system?*
Answer: *For any integration, the school's background software and server will need to be checked.*

Question 2: *How is data protection and security ensured since it is managed as a centralized system?*
Answer: *Punarjjani is put up on Media Lab Asia servers in Mumbai and the back up is taken every three days. Also, access through a secure username and password ensures that a school can only access data on its own pupils.*

Question 3: *If this system is proposed to SSA for countrywide implementation, can it handle that much data and numbers?*

Answer: *Yes, the system is ready for that. In Haryana, it is being used across all SSA blocks.*

Question 4: *Are the individual lesson plans according to state-specific curricula?*
Answer: *No, the lesson plans are general. But if a teacher feels that a more relevant lesson plan is required, he/she can customize it or upload one's own. The lesson plans can be localized.*

Question 5: *How is the Rehabilitation Council of India (RCI) associated with Media Lab Asia work?*
Answer: *There is collaboration between the two. The knowledge partner is RCI, while Media Lab Asia looks at the technology side.*

4. ICT for Visually Handicapped: *George Abraham, Chief Executive Officer, Score Foundation*

George Abraham, Chief Executive Officer, Score Foundation, and himself a person with visual impairment, gave an address rich with his personal stories and experiences, examples, and insights. He highlighted the key issues that hinder the visually impaired from realizing their potential and functioning independently and productively. Abraham began his address by pointing to the widespread ignorance about the abilities of PwD, evident even in the five-year plans where the focus has been on 'providing' aid, shelter, and assistance to PwD. The focus is entirely on the disability, and this affects the attitude of policymakers, parents, and the society at large. He urged that PwD not be seen as people who need to be helped but as people with potential and possibility to do as well as any other given the right kind of environment and investment in their education and talent.

Elaborating on the issue, Abraham mentioned the key issues that numerous of his workshops with young visually impaired boys and girls had brought forth: poor knowledge levels, limited ambitions, low critical thinking skills, and poor language and computer skills, all of which shrink their employability quotient. Abraham mentioned the achievements of PwD who with good education and inputs had successfully overcome their disabilities, like David Blunkett, the visually impaired eminent politician who has held many key posts in the U.K. government; Erik

Weihenmayer, the only blind person to reach the summit of Mount Everest; and Rajinder Johar, who successfully set up and run for over two decades the organization Family of Disabled despite being paralyzed neck down.

With regards to the role of ICTs, Abraham highlighted the big role ICTs had to play in inclusion, especially by enabling communication, disseminating information, and changing mindsets. He talked about the work Score Foundation was doing, including cricket tournaments for the blind and the website and radio program Eyeway, which seek to empower the visually disabled and help them claim their rights through information dissemination and advocacy. Abraham concluded his address by featuring a short version of an episode from his TV show *Nazar Ya Nazariya*, highlighting how incorporating the idea of universal thinking and universal design could bring about truly 'inclusive development' and help the blind and people with other disabilities contribute to the society as equals.

5. Assistive Technology, Web Accessibility, and Mobile Accessibility for Visually Handicapped: *Anubhav Mitra, Saksham Trust*

The presentation by Anubhav Mitra from Saksham Trust focused on how access could be improved for a person with blindness and low vision and what requirements a system should meet to improve this access. Talking of assistive technologies, Mitra stated that the discussion had moved beyond just computers to mobile devices and further to localization, independent mobility, and reading experience.

Mitra discussed the various assistive solutions that are easily available on different platforms: computers — screen readers and magnifiers, OCR, and refreshable Braille display; mobile devices — voiceover for iOS, talkback for Android, nuance talks & Zoom and Nokia screen readers for Symbian Sr 60 devices, Blackberry devices. Stating that use of local languages improves the speed and efficiency of learning, Mitra pointed to the availability of ICT solutions in local Indian languages, for example, screen readers are now available in Indian languages for computers, and mobile software in Hindi, Tamil, and Telugu is available for Android and Hindi is available for iOS devices. Solutions are also available for independent mobility, such as mobility devices like smart canes and navigation maps for

Android, iOS, and other compatible devices. Mitra stressed that visually impaired children should be provided these solutions and trained in their use. Reading experience for the visually impaired persons can also be augmented using the available reading experience solutions for various platforms, open format like e-pub3, and use of Unicode fonts.

Emphasizing the need to ensure accessibility for persons with visual impairment, Mitra argued that both web and mobile accessibility are critical. Currently, the bulk of knowledge easily available on the web is not accessible by the blind. Web accessibility can be ensured by adhering to some proven practices like following the WCAG 2.0 and GIGW guidelines; making accessibility a part of web design, using Unicode fonts for e-content; using responsive design, HTML 5, and Aria; and undertaking the web accessibility testing cycle. For mobile devices, accessibility requires that all mobile applications, websites, and interface be accessible with screen readers. Mitra pointed out that there is a good business case for making web and mobile accessible to all, as it opens up services like e- and m-banking and commerce to many more potential clients.

Concluding remarks for Session 2

Pramila Balasundaram concluded the session by thanking the presenters for a very informative session that had greatly improved awareness about the various issues and concerns around the topic of 'inclusion' and the different ICT solutions that are currently available.

Session 3

Pramila Balasundaram welcomed back the participants to the third and last session of the workshop and chaired the session.

6. Challenges in the Use of ICT in Teaching and Assessment Methodologies in Inclusive Education: *Dr. Himangshu Das, Director, Society for Advanced Study in Rehabilitation*

Reflecting on the information shared by other speakers about the different available ICT solutions for PwD, Dr. Himangshu Das, Director, Society for Advanced Study in Rehabilitation, gave a data-rich presentation on the inclusion aspect and the availability of ICT facilities in private and public schools. Dr. Das made the presentation interactive by engaging the participants to bring clarity to the complex issues he discussed.

Dr. Das began by making a strong case for the use of ICT in teaching, especially to enhance learning, independence, integration, and interaction. Presenting data on a range of variables, including the use and availability of ICT

resources and the competency and skills of the different stakeholders, including general and special education teachers and activity teachers, school administrators, and family members, Dr. Das put into sharp focus the lack of a conducive set up, which was almost absent in government schools. The data that Dr. Das presented is telling, considering that the schools covered were from the Delhi NCR region, which represents among the best available facilities in the country. Dr. Das contrasted this dismal scenario with that of schools that were properly equipped in leveraging ICT and provided the opportunity to CwD, like the Step by Step school, which had shared its exemplary practices earlier in the workshop. Dr. Das defined 'opportunity' in comprehensive terms, including the availability and accessibility of resources, family and professional support, ICT-enriched curriculum, multiple means of engagement, and adaptation.

Concluding his presentation, Dr. Das offered recommendations to address the current deficiencies in ICT deployment at schools. The recommendations ranged from supportive policy framework to ensure availability; focus on research and documentation of best practices; increased collaboration between the IT sector and rehabilitation service providers; focus on training and capacity building of educators and family members; and structured curriculum supporting ICT-based interventions, among others.

Questions from the audience:

Question 1: *Could you please provide the source of the data that has been shared?*

Answer: *The data is from the Society for Advanced Study in Rehabilitation, which was running a foundation course for CwD, an in-service program mainly targeted towards training teachers and administrators. The data was collected over the course of numerous interactions with government teachers, administrators, and coordinators.*

7. Using Bharat Operating System Solutions (BOSS): *Navin Shaw, Senior Technical Officer, C-DAC*

The presentation by Navin Shaw, Senior Technical Officer, C-DAC, focused on the Bharat Operating System Solutions (BOSS), a C-DAC initiative that has tremendous potential for inclusive education. Initially developed for use in the defense sector, BOSS Linux is a free/open source operating system, coming with a GNOME desktop environment with wide Indian language support and packages. Its support for 22 Indian languages represents a step towards creating a unified operating system for the country. Further, BOSS is virus-free and comes with an array of bundled software like office applications and browser applications for use on daily basis.

Given that the cost of software often exceeds that of the hardware, use of indigenous free software like BOSS can greatly address concerns about affordability. Shaw highlighted the utility of BOSS for inclusive education, as it is a free, unified, multilingual operating system that is easy to localize. It can be put to use in schools so that CwD from the lower socio-economic strata can also avail the benefits of technology. The software has already been installed in 20,000 computers in primary schools across Punjab and Haryana.

Questions from the audience:

Question 1: *Is it possible to have both operating systems, Windows and Linux, on a computer?*

Answer: *Yes, it is possible. But if BOSS is introduced to a person in the beginning itself, like in school, then the person would be comfortable in using it and there would be no need to buy and use Windows.*

Question 2: *Do you not think the government should advertise about these free applications that have been developed?*
Answer: *Yes, earlier we were mostly targeting government offices only. Lack of advertising is indeed an aspect that the government needs to address.*

8. ICT for the Deaf and Hard of Hearing: *A.S. Narayanan, Director, National Association of the Deaf*

A.S. Narayanan, the Founder-Director of National Association of the Deaf (NAD) and himself hard of hearing with speech impairment, gave a strong presentation that not only highlighted the needs and requirements of the deaf but also suggested ways that could help the deaf persons better integrate with the mainstream society. At the outset, Narayanan, emphasized that the correct terminology be used, and the persons with this disability be called 'deaf' or 'hard of hearing', and not 'hearing impaired'.

Setting the context, Narayanan said India was home to 18 million deaf people who have difficulty in communicating with the world around them. They receive poor education and hardly get any training for employment; 80 percent of the deaf in Delhi are illiterate. In this scenario, NAD is seeking to protect the rights and quality of life of the deaf and hard of hearing individuals in India. NAD seeks to create a united front of deaf people across India and promote equal rights for them by lobbying with government bodies and policymakers. A recent success came to NAD when due to its lobbying with the Ministry for Information & Broadcasting, the 2014 Republic Day coverage was for the first time aired on the three major Doordarshan channels along with a sign language interpreter. Narayanan pressed that the world be opened up to the deaf by improving their access to information through provision of facilities for sign language and interpretation. Alongside, he also emphasized on the need for sensitizing the general public about the issues and concerns of deaf people. On the issues of inclusive education, Narayanan argued that as a deaf child cannot understand what the teacher is saying or read from a book, the mainstream teaching method cannot be used with him/her. Hence, the schooling for deaf and normal children should be separate and only at the college level should they study together. Speaking of the technological revolution, Narayanan said that the fast progress in ICTs, such as text messages, e-mail, Skype, and video chat, was having a major impact on the lives of deaf persons. Internet and other technologies, however, needed to become completely accessible to them, and could be made so by the provision for sign language interpreters and relay services.

Looking ahead, Narayanan hoped that after Rights of Persons with Disabilities Bill is passed by the parliament, all deaf people would have full access to communication and information by the year 2025.

Questions from the audience:

Question 1: *Why do you suggest that the deaf children should not go to the mainstream school?*

Answer: *Mainstream schools lack the facilities to teach them, as India has 18 million deaf people and only 250 interpreters. However, once the deaf children learn to read and write and can interact, they have the skills to handle mainstream college and can attend that.*

Concluding remarks for Session 3

Pramila Balasundaram concluded the session by thanking the presenters for providing insights into the negative truths that exist and the positive inputs that can offer solutions. This knowledge of gaps and opportunities is the first step towards promoting inclusive education and building an inclusive society.

Concluding Remarks

Pramila Balasundaram, SAMADHAN, concluded the workshop by thanking everyone and highlighting the windows of opportunity that the workshop had created. The experience had been positive and enriching, and met a crucial need for bringing greater awareness about the technologies that are already available and accessible for use.

Drawing a parallel with the human body, the proper functioning of which requires the different body parts to work in tandem, Balasundaram called upon the different stakeholders working on CwD issues to come together and work in collaboration to bring about meaningful change in the lives of CwD. If the policymakers, parents, special educators, researchers, NGOs, academicians, and advocates combine their skills and expertise, a way forward is assured. It is with linkages and interdependence that the outreach can be expanded to all categories of disabled from all strata. The need is, she emphasized, to set up a comprehensive service delivery mechanism and network to share knowledge and best practices.

Amita Tandon, UNICEF, joined in to thank the workshop organizers and participants for the opportunity to learn from each other. She stressed the need for setting up a platform, like an online group, to bring the different stakeholders together for sharing and updating information so that all the promising work and learning, however small, can be shared and leveraged. Tandon emphasized that UNICEF is committed to support any innovations in the field of education, and reiterated the need for continuous learning and information exchange.

Speaking on behalf of C-DAC, M. Kumar thanked SAMADHAN and UNICEF for the workshop and for providing C-DAC an opportunity to participate and present its work. Kumar called for collaboration and inputs from institutions, special schools, and NGOs for C-DAC's new project towards developing and implementing innovative educational apps in Indian languages for mobile phones and tablets.

The Way Forward

The workshop brought into sharp focus some key areas that should be addressed to strengthen the development and use of ICT solutions for children with disabilities:

- Create a common platform to enable information exchange and learning about the best practices and ICT solutions for inclusive education
- Promote universal design (UD) in creating learning material and educational environment so that learning is accessed, understood, and used by all children, irrespective of their impairment or disability
- Foster R&D and collaboration between IT providers, special educators, academicians, parents, and other stakeholders for developing affordable and scalable applications and aids for persons with disabilities
- Conduct trainings and capacity building of special educators in the use of ICT, with focus on training teachers to respond appropriately to the specific needs of different disabilities
- Localize ICT applications and content to meet local needs in India, especially by improving availability in different Indian language
- Increase awareness and use of the already available ICT applications and aids for persons with disabilities
- Create a bouquet of ready-to-use free basic mobile applications that can be localized and immediately deployed
- Improve availability and accessibility of technology resources and conduct training programs for the disabled and their families on the different available technologies
- Foster an overall positive environment for leveraging ICT in schools, including through a structured curriculum supporting ICT-based interventions
- Ensure mobile and web accessibility through adherence to some proven practices like the WCAG 2.0 and GIGW guidelines
- Sensitize policymakers, stakeholders, and the general public about the issues and concerns of PwD

Annexures

1. Annexure 1: Agenda of the Workshop

2-Day National Workshop on "Using ICT for Inclusive Education in India" (Jointly conducted by C-DAC and SAMADHAN; Supported by UNICEF) February 23–24, 2015		
Program Schedule		
Day 1 (February 23, 2015)	**Timings**	**Duration**
Registration	9:00AM to 10:00AM	1 Hour
Inaugural Session (Welcome, Lighting of Lamp, Address by Chief Guest, Address by Other Dignitaries)	10:00AM to 11:00AM	1 Hour
Pre-lunch Tea Break	11:00AM to 11:30AM	30 Minutes
Session-1		
Speaker – Kartik Sankar, SAMADHAN Topic – Desk Analysis - A Report	11:30AM to 12:00PM	30 Minutes
Invited Talk-1 Speaker – Amita Tandon, Education Specialist, UNICEF, New Delhi Topic – Universal Design and Accessibility	12:00PM to 12:30PM	30 Minutes
Invited Talk-2 Speaker – M. Kumar, Senior Technical Officer, C-DAC Topic – ICT and Mobile Technologies for Inclusive Education	12:30PM to 1:00PM	30 Minutes
Lunch	1:00PM to 2:00PM	1 Hour
Session-2		
Invited Talk-1 Speaker – Representatives of Step by Step School Topic – User Experiences	2:00PM to 2:30PM	30 Minutes
Invited Talk-2 Speaker - Prof. Amitav Mishra, Director, School of Special Education, IGNOU Topic – Designing Inclusive Classrooms – ICT Complementing UDL	2:30PM to 3:00PM	30 Minutes
Invited Talk-3 Speaker – Revathy Rugmini, Regional Representative – Asia, Leonard Cheshire Disability Topic – Findings of ICT Projects for Education of Children (Coorg, Serampore, Mumbai)	3:00PM to 3:30PM	30 Minutes
Post-lunch Tea Break	3:30PM to 4:00PM	30 minutes

Day 2 (February 24, 2015)		
Session-1	**Timings**	**Duration**
Invited Talk - 1 Speaker – Leena Chourey, C-DAC Topic – Accessible Computing @ C-DAC	10:00AM to 10:30AM	30 Minutes
Invited Talk - 2 Speaker – Surekha, Senior Project Engineer, C-DAC Topic – ICT for Children with Intellectual Disability	10:30AM to 11:00AM	30 Minutes
Pre-lunch Tea Break	11:00AM to 11:30AM	30 Minutes
Session-2		
Invited Talk – 1 Speaker – Gaurav Takkar, Senior Research Scientist, Media Lab Asia Topic – Punarjjani: A Web-based Tool to Assist Special Teachers in Assessment of Mentally Challenged Children	11:30AM to 12:00PM	30 Minutes
Invited Talk - 2 Speaker – George Abraham, Chief Executive Officer, SCORE Foundation, New Delhi Topic – ICT for Visually Handicapped	12:00PM to12:30PM	30 Minutes
Invited Talk - 3 Speaker – Anubhav Mitra, Saksham Trust Topic – Assistive Technology, Web Accessibility, and Mobile Accessibility for Visually Handicapped	12:30PM to 1:00PM	30 Minutes
Lunch	1:00PM to 2:00PM	1 Hour
Session-3		
Invited Talk – 1 Speaker – Dr. Himangshu Das, Director, Society for Advanced Study in Rehabilitation Topic – Use of ICT in Teaching and Assessment Methodologies in Inclusive Education	2:00PM to 2:30PM	30 Minutes
Invited Talk – 2 Speaker – Navin Shaw, Senior Technical Officer, C-DAC Topic – Using Bharat Operating System Solutions (BOSS)	2.30PM to 3.00PM	30 Minutes
Invited Talk – 3 Speaker – A.S. Narayanan, Director, National Association of the D e a f Topic – ICT for the Deaf and Hard of Hearing	3:00PM to 3:30PM	30 Minutes
Q&A Session, Feedback from Participants, and Concluding Remarks	3.30PM to 3.45PM	15 Minutes
Post-lunch Tea Break	3:45PM to 4:15PM	30 Minutes

2. Annexure 2: List of Resource Persons

Speakers	Designation	Affiliation	Email
Amita Tandon	Education Specialist	UNICEF, India	atandon@unicef.org
Amitav Mishra	Director (Honorary), Professor in Special Education	School of Special Education, IGNOU	amitav@ignou.ac.in
Anubhav Mitra	Program Manager	Saksham Trust	anubhav@saksham.org
A.S. Narayanan	Director	National Association of the Deaf	as_narayanan@hotmail.com
Gaurav Takkar	Senior Research Scientist	Media Lab Asia	gauvrav.takkar@gmail.com
Gauri Rao and Eishwinder Juneja	Special Educators	Special Education Department, Step by Step school	info@sbs-school.org
George Abraham	Chief Executive Officer	Score Foundation	george@eyeway.org
Himangshu Das	Director	Society for Advanced Study in Rehabilitation	reception.sasr@gmail.com
Kartik Sankar	Consultant	SAMADHAN	kartik.sankar@yahoo.com
Leena Chourey	Senior Research Scientist	C-DAC	leenac@cdac.in
M. Kumar	Senior Technical Officer	C-DAC	mkumar@cdac.in
Navin Shaw	Senior Technical Officer	C-DAC	navins@cdac.in
Revathy Rugmini	Regional Representative - Asia	Leonard Cheshire Disability	revathy@lcdsouthasia.org
Surekha	Senior Project Engineer	C-DAC	surekhak@cdac.in

This workshop report has been composed by Kavita Sharma (*kavita_sharmark@hotmail.com*) on behalf of SAMADHAN.