

Gathering garbage or going green? Shifting Social Perspectives to Empower Individuals with Special Needs

Sumita Sharma¹, Krishnaveni Achary², Marianne Kinnula¹, Netta Iivari¹, and Blessin Varkey³

¹INTERACT Research Unit, University of Oulu, Oulu, Finland

²Lady Irwin College, University of Delhi, New Delhi, India

³Tamana, New Delhi, India

[^firstname.lastname\[at\]oulu.fi](mailto:firstname.lastname[at]oulu.fi)

ABSTRACT

Digital technologies are increasingly used with individuals with special needs for skill-building, social inclusion, and empowerment. However, different stakeholders involved in raising an individual with special needs have different and sometimes conflicting understanding of empowerment and motivations towards it. Using an empowerment framework, we collaboratively analyzed and critically reflected on the design and outcomes of three user studies conducted at a special needs school in New Delhi, India. The studies focused on learning how to make compost out of everyday kitchen waste, to assemble a solar lantern, and to buy groceries from a local store. Findings from the analysis provide insights into the complex socio-cultural conditions that enable, and in some cases limit, empowerment of individuals in an underserved and special needs context. We contribute to discussions on empowerment of children through design and use of digital technologies.

Author Keywords

Individuals with special needs; Empowerment; Social Inclusion; Genuine participation; Underserved Context.

CSS Concepts

•Social and professional topics~User characteristics~People with disabilities •Human-centered computing~Human computer interaction (HCI)~HCI theory, concepts and models

INTRODUCTION

In child-computer interaction (CCI) research, empowering children to have a voice and influence on the design of technology that affects their learning and day to day activities is postulated as a key goal [8,19,21,22]. Several studies address empowerment of children in the context of design and Making (e.g. [19,21,22]). However, the studies so far have been carried out in wealthy Western country contexts and with typically developed children, and only a limited number of studies ([12] and [25] as notable exceptions) critically examine approaches to empowerment

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in other contexts and for individuals with special needs. There is a growing interest, however, on the use of technology for individuals with special needs to support and train for social and cognitive skills [15,16,24]. This trend has also permeated into the Global South [2,33], the context of our study. When special needs organizations incorporate technology mediated interventions in classrooms, the overarching aim is to empower and promote social inclusion for individuals with special needs [24,30,33].

In this study, we will critically scrutinize empowerment of individuals with special needs, i.e. individuals with intellectual and developmental disabilities including but not limited to Autism Spectrum Disorder, ADHD, and Down syndrome [9]. While the chronological age of the individuals varies between 17-40 years, their social age is closer to teens. The context addressed in our studies is India, which as a cultural context provides also novel insights on the literature on empowerment of children produced within CCI. We scrutinize three user studies implemented in the past five years at a special needs school in an underserved environment in New Delhi. In our analysis of the studies, we utilize a framework on empowerment, proposed by Kinnula and Iivari [22] that offers a critical lens towards understanding the impact and effectiveness of children's participation. Empowerment in this study includes allowing for meaningful and effective participation and overcoming social conditions or conflicts that exist among different stakeholders or are inherent to the context of being underserved. These stakeholders include people involved in raising an individual with special needs [12] – parents and caregivers, educators and school admins and other staff, therapists (speech, occupation, counseling), and family, relatives, and friends. In this paper, we present the influence of, and conflicts between the different stakeholders as regards empowerment of children with special needs through meaningful and impactful participation in technology mediated interventions.

This paper is organized as follows: Next, we present the related work in this domain as well as the empowerment framework used in the study. We then briefly describe each of the user studies, the methodology followed in this work, and our findings. Lastly, we discuss the implications of our work from the perspective of different stakeholders, and finally conclude the work.

RELATED WORK

While there is interest in empowering individuals with special needs through technology-mediated interventions in classrooms across the world, we are still building our understanding of how meaningful and impactful it is for the individuals to participate in such interventions. In this section, we first present the challenges in the context of special needs in India, then discuss CCI literature on empowerment of children with special needs, and lastly present the empowerment framework used in this study.

Challenges Towards Special Needs in India

There are several socio-cultural challenges for individuals with disabilities in India – from misinformation and misguidance around diagnosis and interventions to low social acceptance and inclusion as well as limited access to resources [1,2,5,6,10]. For instance, an autism diagnosis in India can take upto 11-14 months compared with 5 months in the US. Lack of information, or worse, misinformation, among specialists such as local level pediatricians, teachers in an integrated school, and special educators, is also common. A study on teacher's attitudes towards disability and inclusive education in Mumbai stated that without prior acquaintance with a person with disabilities, teachers at mainstream schools meant to integrate children with special needs were unable to understand their needs [28]. Similarly, in a study in Kolkata, examining the perspectives of different stakeholders towards autism in private mainstream integrated schools, it was evident that most of the teachers were not aware of autism before having met a student with the diagnosis [20]. Moreover, the Rehabilitation Council of India¹ only recently upgraded their one-year Diploma course in Special Education to a two-year Bachelors' in Special Education, to be at par with a typical specialization degree.

Introducing technology-mediated interventions in an underserved context can also be a challenge [2,6,33] because of resource constraints within the environment, e.g., lack of supporting infrastructure and access to electricity as well as prevalence of the digital divide, where entire communities, due to their socio-economic background, gender, geography, or education, have limited access to technology. Furthermore, prevailing socio-cultural barriers towards individuals with special needs lead to a pronounced digital exclusion even within technology-capable communities [2,6]. For example, economically stable and educated parents might provide a mobile phone to a typically developed child but not to a child with special needs. In contrast, some special schools can also be highly focused on technology-mediated interventions, creating their own niche [33].

Within the special school ecosystem in India, there are key stakeholders who have a direct influence on the everyday decisions and activities available or planned for an individual with special needs [12]. These include *parents*, who in some cases attend the special school with their child, or send a

domestic helper; special *educators* who are employees of the school and have predefined teaching curricula and goals; the *school administration* that is responsible for setting short-term and long-term goals and vision for the school and its students and staff; *researchers* working at or collaborating with the school, having their own agendas and goals for exploration and study; and finally the *individuals* themselves. Conflicts can arise among the different stakeholders in their approach towards empowerment of individuals of special needs.

Empowering Children with Special Needs

Within CCI, several participatory and inclusionary models have been designed and employed for designing with children with special needs [11,12,14,25,26,29]. This includes Guha et al.'s three-part inclusionary model, which starts by identifying first the level of involvement of the target user group that is desirable for the project, and then renegotiating the level of involvement based on the target groups' abilities and preferences and availability of support [14]. In this way, as previous work has also identified, there can be a balance between "empowering children [vs.] overburdening them with responsibility" with respect to their continued participation [12].

However, there are several factors from "a complex web of additional stakeholders such as parents, teachers and carers" that creates unequal power-structures, to the varying social, communication, and cognitive abilities of the children themselves [12] that influence children's participation and inclusion, and thus the level of empowerment that can be realized. Power dynamics among different stakeholders and towards a child with special needs have to be negotiated for meaningful participation of children. Further, in some cases researchers have to rely on special educators or practitioners, who spend considerably more time with the children and have built a rapport, in order to effectively communicate with the children. "Practitioner's understanding of the possible behaviors that may suggest a child's affective states (e.g. boredom, joy, frustration), cognitive states (e.g. focus of attention, curiosity, understanding) and the level of goals' achievement are crucial to delivering intervention that works for that child" [29]. Therefore, previous research advocates for balanced and empathic approaches when working with children with special needs [11,12,26].

While most research on empowering children with special needs focuses on the design and development of a specific game or technology-mediated intervention, there is also recent interest in evaluating the projects and interventions themselves together with children with special needs [35]. The evaluation aims to address the differences in worldviews and life experiences between the researchers and participants when it comes to defining and imaging success. This further helps grounding expectations from a technology-mediated intervention to situate them within the context of interests,

¹ <http://www.rehabcouncil.nic.in/>

needs, and desires of both children with special needs and other stakeholders [11]. Overall, there is a need to shift design and research thinking from disability to ability – to supporting, nurturing, and empowering children with special needs to thrive (e.g. DIY-Abilities [27]).

Overview of the Empowerment Framework

Building on established previous work on designing with and for children, founded on the Scandinavian approach to participatory design [8,19], Kinnula and Iivari [22] propose a four-part empowerment framework to understand how children, and other user groups, can be empowered to make a change through designing, Making, and usage of technology. The first part consists of mapping the context, background, interactions, and discourses between the different stakeholders, based on nexus analysis [31]. This helps us understand the roles of the different stakeholders, including their past histories that shape their present and future, their interactions and relationships, and the discourses in society at large around the participants or activity [17,32]. The second part, which is used in this paper, explores the conditions that allow for meaningful and impactful participation of children; it is derived from Chawla and Heft's conditions of children's effective participation [3]. The five conditions are (a) *conditions of convergence*, which look to empower children by building on their existing life experiences and support structures; (b) *conditions of entry*, pertaining to participation that is inclusive, voluntary, and accessible; (c) *conditions of social support* from the environment and context, with a focus on collaboration, teamwork, and respect; (d) *conditions of reflection*, which pertain to transparency in the process of participation, with respect to power differences, decision-making, and critical reflection on the process and the outcomes; and (e) *conditions of competence*, which emphasize building competence, skills, and knowledge by assigning responsibilities, defining goals, providing information to achieve them, and aiming to create an impact [22]. These conditions enable to scrutinize both the process and the outcomes of children's participation [18]. The third part of the framework differentiates between five forms of empowerment, as understood from prior literature on empowerment [21]. The last part explores the intrinsic and extrinsic values of stakeholders and the value they perceive or assign to an activity or artefact [4,36].

The empowerment framework provides a mechanism for researchers to critically scrutinize the impact and effectiveness of participation, also for vulnerable and underserved user groups. This makes it especially appropriate in the context of our work – with individuals with special needs in India. Using the second part of the framework, we critically examine and thus build our understanding of the meaning and impact of children's participation. In the process, we also uncover various conflicts between the different stakeholders involved in raising an individual with special needs and the tug-of-war

between socio-cultural norms and expectations and the quest for the empowerment of the individual.

METHODOLOGY

In this study, we critically examine the impact and effectiveness of children's participation in three previously conducted user studies. Researchers responsible for designing, implementing, deploying, and analyzing the outcomes of these three user studies collaboratively discussed and critically reflected on the questions in the empowerment framework for each study and also for the overall context (working with individuals with special needs and the different stakeholders in an underserved context).

Participants of the User Studies

A total of 142 individuals, with the chronological age varying between 17-40 years but social age closer to teens, participated in the three user studies. Individuals with special needs have varying social, cognitive, and physical abilities, and in some cases their social age (based on developmental milestones and the Vineland Social Maturity scale [7]) is more significant than their chronological age to consider. The participants of this study were categorized as severely challenged, moderately challenged, or borderline, based on their social and communication abilities measured as Social Quotient (SQ) and their intelligence quotient (IQ). The Vineland Social Maturity Scale is a psychometric assessment to measure an individual's social competence using eight categories of behavior (self-help general, self-help eating, self-help dressing, locomotion, occupation, communication, self-direction, and socialization). It is used to determine SQ and social age [7]. IQ is measured using the Indian adaptation of Wechsler's intelligence scale for children [37], called Malin's Intelligence test [23]. Individuals with both *IQ and SQ < 50* were considered as severely challenged and those with both *IQ and SQ > 55* as moderate-mildly challenged. Participants with either or both IQ and SQ between 50-55 were categorized as severely or moderately challenged based on other factors, such as their day to day level of socialization and communication. Specific participant demographics are shared when describing the user studies.

Description of the User Studies

All the studies included a blend of technology-mediated and hands-on interventions and were conducted in three phases: Phase 1 (a pre-test), Phase 2 (the technology-mediated intervention), and Phase 3 (a post-test). The pre and post-tests evaluate development of a specific skill that is targeted in the intervention. The interventions are described next.

Organic Composting Using Kitchen Waste

The goal of the 15-week composting intervention was to provide hands-on training to participants for composting common kitchen waste, as shown in Figure 1 (left). It was oriented towards teaching entrepreneurial skills, such that participants could potentially replicate the process to develop a small-scale start-up wherein they collect kitchen waste from their local neighborhood, sort through the waste to identify what can be put in a composting machine, and brand

and sell the compost as an organic fertilizer in the same neighborhood for house gardens. A mobile application was developed to assist in learning to differentiate biodegradable and non-biodegradable materials, and then how to sort which biodegradable material can be placed in the compost.

A total of 68 participants (M45, F23), aged between 17-46 years (M=31.5) with severely or profound challenges (SQ=37.9, SD=12.6; IQ=39.4, SD=12.5) took part in the study. 75% of the participants could communicate verbally and 22% had difficulties in communicating. The main outcomes include several participants learning the composting process, while those with profound disabilities required supervision. However, overall there was a lukewarm response to the activity from the parents and educators.

Solar Lantern Assembly Using Virtual Reality

The goal of the 15-week solar lantern intervention focused on learning how to assemble a solar lantern using a DIY kit, as shown in Figure 1 (center-left, center-right), and following instructional videos using a virtual reality headset. The VR headset was used to assist in maintaining attention and focus when learning a new process. Topics such as climate change, electricity, and being more environmentally friendly were also discussed.

A total of 56 participants (M40, F16), aged between 17-44 years (M=26.5), with borderline challenges (SQ=50, SD=10.47; IQ=55, SD=12) took part in the intervention. The main outcomes included participants learning how to assemble the solar lanterns. However, participants did not find a market for their product as it was not decorative enough for high-income groups and too expensive for low-income groups even if they liked its functionality. As a follow-up to the work, participants looked to designing solar *diya* (small earthen candles), which were decorative and affordable, thus suitable for both income groups.

Kirana – Buying Groceries Using Gesture-based Interaction

In the 3-week kirana intervention, participants used a gesture-based application to practice how to buy groceries from a local Indian store, which are called kirana in Hindi [34]. As shown in Figure 1 (right), these local mom-pop style stores consist of a room with rows and rows of shelves full of items lining the walls. Buying an item requires social interaction with the shop keeper (telling which item to buy which they pick from a shelf), mathematical skills to calculate the costs and balance when paying, and decision-

making skills to choose what to buy and if there is enough money to buy the item(s). In addition to the three phases, kirana also had a fourth phase where participants went to an actual kirana store to buy everyday items.

A total of 18 participants (M14, F4), aged between 16-39 years (M=26), with moderate challenges (IQ=46, SD=11; SQ=58, SD=16), and who had basic mathematical skills but were too shy to shop independently took part in the study. Outcomes include participants learning how to buy items from a local store. The special school was also able to procure research funding to further study gesture-based learning for individuals with special needs in their school, enhancing the school's research endeavors.

Data Analysis

A three-session workshop (4.5 hours in total) over two weeks, with two researchers from the special school and a researcher who previously collaborated with the same school, was organized to examine the three interventions. A total of three researchers participated in the workshop, although one was present for only one of the three sessions. The researchers altogether have 26 years of experience in working for and with children with special needs in India and have varying and overlapping backgrounds ranging from psychology and social sciences, to HCI and CCI. At least two of the three researchers were responsible for designing, implementing, deploying, and analyzing the outcomes of each of the three user studies presented in this work. The first two workshop sessions (2-hours each) were audiotaped, and notes were shared after the sessions with all the researchers, allowing them to clarify or further elaborate on any of the findings in the third session (0.5 hours).

The researchers collaboratively discussed and critically reflected on the questions in the empowerment framework [22] for each user study and for the overall context – working with individuals with special needs in India. The focus was on the empowerment framework's conditions for meaningful and impactful participation – which included conditions of convergence (existing support structures), of entry (inclusion and ease of participation), of social support (from the environment and context), for reflection (short and long-term evaluation and impact), and for competence (what is gained from participation, during and after). Both the participation process and outcomes were considered.



Figure 1. (left) participants working on sorting items for composting, (center-left) a participant assembling a solar lantern using a kit, (center-right) the assembled solar lantern, and (right) a picture of a local kirana store.

FINDINGS

Our findings highlight various challenges and opportunities for empowering individuals with special needs. The challenges arise from inherent socio-cultural norms, expectations, and limitations as experienced by the different stakeholders. Four key stakeholder groups, with varying levels of influence on the day to day activities at the school, were identified: parents, special educators, researchers, and individuals with special needs. Next, the main findings on the five conditions of the empowerment framework are presented. We also focus on the conflicts that arise between the different stakeholders in supporting empowerment of individuals with special needs from the perspective of the conditions for meaningful and impactful participation.

Conditions of Convergence

The conditions of convergence focus on empowering children by building on their existing experiences and opportunities. The first question asks whether *it is easy and natural for children to participate*. At the special school, most of the interventions occur within the school premises and during the school day, making it easy to participate. The school building is also accessible with ramps and elevators. Moreover, the interventions are designed based on the needs and desires of the participants, and care is taken to ensure that participation is smooth and a positive experience overall.

When discussing *existing organizations and structures supporting children's participation*, there was evidence of **socio-cultural conflicts arising from the parents' and educators' perspective regarding certain activities**. From the researchers' perspective, both the composting and solar lantern activities were designed to instill entrepreneurial skills in individuals with special needs. Having learnt how to compost using everyday kitchen waste, participants could develop a small-scale bio-fertilizer startup. For instance, by collecting kitchen waste from houses in their neighborhood and reselling it for house gardens after composting. However, parents did not share the same enthusiasm for composting and instead equated the activity with garbage collection, which was socio-culturally considered a low-skill profession. Parents further felt that making their children participate in low skill jobs denied them opportunities for more skilled jobs and that "society" would not look too kindly on them for treating their child with special needs differently than their neuro-typical child. Similarly, participation in the solar lantern intervention was frowned upon as it, too, was considered relating to a profession (of an electrician) that was considered to be a low-skill one. Further, special educators did not want to handle garbage or kitchen waste for composting and stated that the solar lantern assembly required engineering skill that they did not possess.

To convince the parents of the merits of composting and to break the **gathering garbage image**, researchers modeled the activity as a lab experiment – together with a lab coat, apron, gloves, and mask. Further, researchers would send pictures of the children using the composting setup (as

shown in Figure 1 left) to showcase the scientific merit of the activity and relate it to **going green** to highlight its environmental merit.

In the solar lantern assembly, another problem arose when the tasks required learning how to use a screwdriver. Parents were worried that their child would be tempted to use it outside of the activity context, which could be **dangerous**. For instance, they might start playing with electricity. Further, using an external power supply or plugging things into a socket was also considered dangerous. This led to replacing the power supply with batteries and relating the activity to building toys using a kit, rather than to an engineering activity, to dissuade participants from using the tools outside of the study context.

Acceptance for kirana from the parents and special educators was easier to obtain. **Parents supported the use of novel technologies** that they considered at par with the Global North and the skill of buying groceries from a local store was desirable for self-efficacy. From the special educators' perspective, participation in kirana was in lieu of a similar classroom activity that required them to simulate the scenario using physical objects. Therefore, kirana supported their teaching goals without the added burden of learning a new technology as researchers moderated the sessions.

Gauging whether *the activities are based on children's own issues and interests* was not a straightforward task, however. For instance, many different **stakeholders act as proxies for individuals with special needs**, especially for those who are unable to communicate verbally. Nevertheless, it was noted that participants were usually excited and motivated to participate in activities that were generally different than their regular classes, by being more hands-on and game-like, as opposed to sitting and listening to a teacher. Moreover, these researcher-driven projects emphasized activities that are very relevant for the participant and their future: the activities aim to empower individuals to be independent, whether by practicing how to buy everyday items from a local store or learning specialized skills that could open up avenues for small-scale startups. The activities also emphasized social inclusion, confidence building, and allowing for civic participation through, for example, recycling household waste.

Conditions of Entry

Conditions of entry pertain to participation that is inclusive, voluntary, and accessible. When discussing whether *the participants had been fairly selected, or had somebody been excluded, and why*, it has to be noted that for individuals with special needs, the tasks' requirements and participants' abilities influence the inclusion and exclusion criteria. For composting, participants with known eating disorders were excluded from the study to decrease the possibilities of triggering harmful behaviors. Further still, individuals prone to eating non-edible things or their favorite food regardless of where it is kept, were also excluded. For example, a participant might be tempted to lick a chocolate wrapper that

is in the food sorting bins. The sessions were also held right after lunch when participants are full to prevent these problems. For solar lantern, participants who had visual challenges or poor hand-eye coordination were excluded. For kirana, there was no specific exclusion criteria. Overall, the goal was to include participants who would benefit from the intervention without triggering harmful behaviors.

The discussion then moved towards understanding whether participation is voluntary, why or why not. From the perspective of the participant, their participation in a study at the school is scheduled within their school day and activities, making it almost mandatory at the beginning. Further, several sessions are required before it is possible to conclude that participants have understood the conditions of participation to make an informed decision. In these sessions, the goals of the intervention or overall project are discussed, the tasks and activities are explained, and questions or doubts are clarified. Therefore, **participation usually starts out as being mandatory and then switches to being voluntary**, where consent to participate is obtained several times during the course of the study as the participants improve their understanding of the activity. A similar approach is also employed with the parents, where they are requested to let their child attend a few sessions before confirming (or denying) their consent to participate. Of course, parents are free to deny participation also initially, as was in the case of composting, where parents only agreed once the going green concept was highlighted.

In the context of a special school, *the location and schedule for the activities is easy to access for children and their families*. The school premises are accessible for individuals using a wheelchair with ramps and elevators connecting each floor of the building. All the interventions mentioned in this work were conducted at the school, with the solar lantern and kirana in a classroom and composting in an open area within the school's gated premises. The schedule for the activities was negotiated with the class teachers and parents, to enable a comfortable process for all stakeholders involved.

Conditions of Social Support

Conditions of social support focus on collaboration and teamwork, and generally on supportive atmosphere for participation. The questions inquire whether *the environment is supportive; there is team spirit and how it could be encouraged; children support and encourage each other and how this could be supported; all participants are respected; and all participants act friendly and politely and how this could be encouraged*. In the context of special needs, social and peer support, and collaboration and team building depend on a multitude of factors from the **participants' level of verbal communication and cognitive abilities to the devices or tools being employed in the intervention**. Intragroup interactions depended mainly on the verbal communication skills of the participants. Even if participants want to collaborate and support each other socially, challenges in verbal communication can limit what is

possible. Volunteers (college students working for community credits) who work with the special school are encouraged to become friends with the students at the school and also to mediate friendships among them. To cultivate team spirit, two main tactics were used in the composting and solar lantern interventions. First, participants who excelled in a specific activity or task or in using a specific tool planned for the day would be designated as the unofficial group leaders of those sessions. This would allow them to help others in the group and for others to feel more comfortable in approaching them for help. Second, team building activities were encouraged. This included singing songs together while sorting through kitchen waste for composting. Participants also encouraged each other by cheering and applauding for those who finished a task or answered a question correctly.

However, there was an issue of **discouragement or negative attention through teasing**. In this case, participants would tease or make fun of someone, sometimes drawing attention to someone's mistake or behavior. Two main reasons were attributed to teasing behaviors. First, such behaviors would garner immediate attention from the adults and participants in the vicinity. Employing negative behaviors to get attention is unfortunately learned behavior, where participants employ socially inappropriate behaviors, or gestures, as a mode of communication. Usually researchers ignore such teasing behaviors and reward (through applause) and appreciate socially appropriate behaviors. Second, teasing and making fun of someone else's mistake was also a way to move the focus away from their own mistakes. In this case, researchers would intentionally make a mistake and wait to be teased. Then the researchers would turn it into a teaching moment by saying that it is okay to make mistakes and that it is okay to want to learn and to not know. For the solar lantern, the process of assembling was new for everyone, so there was less shame in making mistakes and more collaboration among participants because they all had similar challenges.

When considering whether *everybody's opinions and thoughts are considered valuable*, it is important to note that **participants' communication abilities varied quite significantly**. For those who communicate verbally, their opinions and thoughts were easily incorporated or addressed. In kirana, participants who were vegetarian did not want to buy eggs and this was respected. Participants also mentioned wanting to focus on healthier food options, rather than junk food, and this was incorporated in the task. For participants who are not verbally communicative, care is taken to include them in the activities by providing physical ways to complete a task – placing objects on a blue (non-biodegradable) or green (biodegradable) tray for composting. It is difficult however to comment on whether their thoughts or opinions are heard and taken not account.

Conditions of Reflection

Conditions of reflection pertain to transparency in the process of participation with respect to existing power

differences, decision-making, and critical reflection on the process and the outcomes. When discussing whether *power differences exist between participants*, and whether *the power differences had been deliberately negotiated*, two main power imbalances were identified. First, there could be **varying levels of abilities among the participants**, various limitations due health issues which affect whether they are able to attend school regularly or not, and varying levels of comfort towards verbal communication. Participants who do not communicate verbally are seen to be more submissive and less capable than their peers who communicate verbally. When it comes to project work or classroom activities, if the participants are not able to communicate, people may assume they have not understood or learnt the task, whereas the participants who are able to communicate verbally, even if they do not remember the task or are not able to complete it, they are able to ask questions, sometimes repeatedly, and are thus deemed more capable. To negotiate such power differences, care is taken to give attention to all participants, and provide multiple ways to complete a task or answer a question. Second, **within the Indian socio-cultural context there can be a large power distance** between those assumed to have authority and those assumed to not. This means that the school administration has power over the special educators and researchers, but also parents have some degree of power over the school administration. In the special needs context, parents of the participants are quite heavily involved in the day to day activities and tasks, mediating and deciding on the behalf of the participants. This is because it's the parents' responsibility to raise the child, sometimes with limited social support. Thus, parents stay in close contact with the school administration, special educators, and researchers.

When exploring *who makes decisions and why*, and *do all participants understand reasons for decisions*, it was no surprise that most of the **decision-making power lies with the adult stakeholders**, with the parents being the most influential. Within the Indian context, decision-making power follows a somewhat strict social hierarchy with authority figures likely having the most influence. Decision to participate can also be based on social status or social consciousness, as in the case of composting where handling waste had its own connotations in society. However, parents are encouraged to allow the child some level of autonomy, for instance, deciding on what hairstyle they should have, when they should have a tea break and if they should drink tea or coffee. For the interventions discussed in this work, decisions were made on the participants' behalf to keep them safe and out of harm. This included replacing the power supply of the solar lantern kit with batteries to reduce the chances of playing with electricity. While participants were explained the reasons for most of the decisions pertaining to their participation, they may or may not find them interesting enough to remember.

There are two main aspects to consider when understanding *occasions for participants for critical reflection on the*

process and the outcomes as well as *occasions for evaluation for participants on both individual and group level*. First, there is a question of **how to include participants, who are non-verbal communicators**, in the evaluation. This was achieved in composting by asking participants to physically place items on a blue (non-biodegradable) or green (biodegradable) tray. Further, participants were evaluated through a "who wants to be a millionaire" type game, where they could answer by selecting the right button and also win fake money. Second, traditional evaluations, using questionnaires or tests, were conducted by volunteers, as they would not be as familiar to the participants, and therefore the participants would not ask them for answers or hints. Participants would inquire about their performance in the evaluations and would want to know how well they performed. They would tend to remember their performance but **not necessarily be able to recall the task, activity, or concept that they learnt**. Similarly, critically reflecting on activities and outcomes was also challenging as once a participant learnt something new, they would sometimes **not recall the learning process** and assume they knew how to complete the task previously.

Understanding the outcomes, expectations, and decision-making required in a project, from the perspective of the participants and their parents, can be a challenge. For instance, participants assumed that at the end of the entrepreneurial projects, they will get jobs right away. Parents also inquire from the school staff, special educators, and researchers how long their child must attend a special school and by when they will graduate (and go for higher education or employment). There is a strong emphasis on the school, and the projects they endorse, to provide teaching, training, and skills for independence. This expectation directly affects the type of projects parents willingly support.

Conditions of Competence

Conditions of competence emphasize building competence, skills, and knowledge by assigning responsibilities and goals, providing information to achieve them, and creating an impact. As mentioned previously, in the context of special needs several different stakeholders act as proxies for the participants. When considering *what kind of responsibility children have or do not have, and why*, it was evident that the onus usually lies with the different adult stakeholders. It is the researchers' or special educator's responsibility to provide information, instructions, and guidance for an activity. The special educators are also responsible for making sure the individuals' schedule is followed and that they arrive at the correct location in the school premises as planned. From the individual's perspective, they are responsible for following instructions and asking for help. During the course of the intervention, the responsibilities of the individuals can also be readjusted to match their experiences or skills. For composting, the class teacher would drop the participants to the open area inside the school premises and leave. The participants and researchers would then have to take out the equipment for composting at the

start of the activity and put it back at the end. This was turned into an activity in itself, led by one of the participants. Inadvertently, therefore, **participant responsibilities were renegotiated during the intervention.**

Looking at *who defines the goals for the activity* and whether *children are allowed to take part in defining the goals, why or why not; participants understand the goals; everybody gets a chance to contribute; and all participants listen to each other*, it was evident that **adult stakeholders play an important role in defining the goals.** Further, goals, similar to responsibilities, can also be renegotiated during the course of the project. For composting, the emphasis was on sorting kitchen waste and not learning how to peel vegetables as that would require experience with using a knife. From the participants' perspective, they are reminded of the main goal of the intervention regularly for them to understand their role and tasks. **Participants' contributions and team dynamics are usually moderated** by a researcher or special educator to ensure fair attention is given to everyone and everyone has a positive experience.

When it comes to whether *children have all information they need and how they could get it*, overall, very **focused information is provided to the participants**, which is possibly also very limited in scope. For composting, participants were told that they would make an organic fertilizer. More streamlined instructions and information are provided during the sessions and often repeated. Participants who are able to communicate verbally are also free to ask questions to obtain more information about the activity.

Zeroing in on the impact of participation, we discussed whether *children's activities have a real impact; children learn something and learning builds on top of previous knowledge/competences.* Impact and learning outcomes vary widely between activities. The composting intervention included understanding the differences between living and non-living organisms, and biodegradable and non-biodegradable material. Further, there was a tendency for participants to match items based on color – putting a green plastic bottle or bag on the green tray for biodegradable items. This color matching process, used heavily within the school to assist in matching objects and shapes, had to be unlearned to avoid a green plastic item being put in the composting pile. For the solar lantern, several participants were assigned as brand ambassadors of the product and then trained to sell it in the local community. However, high-income families desired the product to be more decorative and it was too expensive for low-income families even if they found its functionality useful. Participants then learnt about designing products with a target audience in mind and redesigned the solar lantern as smaller decorated “*diyas*” (earthen candles), which are popular during the Indian festival of lights. In this way, they designed a product that was more attuned to their end customers.

It is difficult to answer whether *the work process supports children to initiate future projects by themselves* without

revisiting how decisions are made in an Indian context in general. Decision-making in Indian families is collaborative and usually dominated by male members. In the case of individuals with special needs, much younger sibling may have more decision-making power than the individuals. It can be said, unfortunately, that individuals with special needs may have the least priority when it comes to decision-making, making it almost impossible for them to initiate future projects by themselves.

Answering the question *does the project result in tangible outcomes* revealed some interesting findings. While composting and solar lantern were geared towards entrepreneurship, they both had very different outcomes. Composting suffered from low socio-cultural acceptance from parents, special educators, and even the school administration, and therefore, was easily forgotten when it ended. In case of the solar lanterns, a small follow up project was initiated close to the Indian festival of lights where “*diyas*” were decorated and made solar capable. In this way, a product that was affordable for low-income families and decorative for high-income families was created. In kirana, participants were trained to shop from a local grocery store, and carried this learning forward.

DISCUSSION

This paper was set to analyze and critically reflect on what empowerment of children with special needs in India may entail, including the challenges. The design and outcomes of three user studies conducted at a special needs school in India were inquired by utilizing a framework on empowerment. Interesting findings on the participation of special needs children and associated cultural factors were revealed. Next, the results are summarized and their implications discussed.

The Significance of Adult Proxies

The studies show that there is a number of stakeholders acting as proxies for children, shaping empowerment of children in significant ways. Most significant actors in these studies were parents and special education teachers, as also identified in previous work with children with special needs in the Global North [12]. In Guha et al.'s [14] inclusionary framework for working with children with special needs, they advocate renegotiating children's level of participation based on the level of assistance that can be provided by these stakeholders. Even if both of these stakeholder groups definitely act on children's best interest in mind, in our work we experienced that they can also be seen as limiting children's participation, due to, for example, cultural issues or workload and expertise related factors. Awareness of these adult actors on the significance of their action on the empowerment of the participants needs to be emphasized.

Special Education Schools as Sites for Empowerment

One thing that worked in favor of children with special needs in the context of our work was how the schools were open for this type of interventions and that they had arrangements supporting participation in the sense of accessibility. Previous research with children with special needs also

usually involves collaborations with a special needs organization or school [15]; hence, children with special needs are usually not expected to physically travel to the researchers' place of work. Of course, this is not possible when an extensive technological setup is required [24].

Communication Challenges

Challenges related to communication abilities of the participants became emphasized in our study: without verbal communication skills, it might be very challenging for researchers to understand the participants' interests or the voluntariness of their participation as well as to engage them equally in all activities and decision-making. A lot of flexibility is needed in the arrangements to fit them with the participants. Previous work on co-designing together with children with special needs and their typically developed peers identified methods to allow participants with varying social and communication skills to contribute, e.g. with activities that had open-ended answers [12]. Further, information provided to participants is staggered, sometimes over several sessions, and at different levels – from the overall goals and outcomes of the intervention to the goals and expected outcomes of the day's session – and “if things go wrong, resolving them is not just a matter of having a good conversation, but involves all other stakeholders” [12].

Empowerment as a Sensitive, Delicate Matter

Our studies show that very sensitive matters involved: contemplation of inclusion and exclusion criteria, considerations on the voluntariness of the participation and ways on how to ensure it, discussions on the social aspects and relationships involved, or the acknowledgement of the lack of decision-making power of the participants all reveal them. It is imperative to ensure that the benefit of participation far outweighs the efforts it demands [12]. Further, the level of participation realizable for a child with special needs is based not only on their ability to socialize or communicate, or on their cognitive skills, but also on the support available from different stakeholders [14]. Within the Indian context, we observed strong socio-cultural norms and expectations dictating the level of stakeholder support and motivation towards children's participation.

Reframing the Evaluation of the Projects

Inviting participants to critically reflect on the process and outcomes of the projects poses a clear challenge. This becomes especially contentious when the parameters to measure success are based entirely on learning models derived from typically developed children. It is important to take into account participants' individual worldviews and experiences in determining the metrics for success [35]. Though, this is usually not possible as different stakeholders bring in their own expectations and agendas, which sometimes creates a troubling narrative – to ‘fix’ behavioral and social challenges faced by children with special needs through technology-mediated interventions [11].

We maintain that the question of the future of the individuals involved is paramount here. Interventions and projects are

short lived, but it is still essential to consider what skills they develop and how those skills help in the long term in e.g. helping to get a job and to become independent. Overall, outcomes vary significantly and when understood together with the challenges towards mapping learning outcomes, it can be said that most interventions do not produce tangible outcomes. Instead, hopefully each intervention contributes towards questioning, and in some cases shifting ever so slightly, existing social perspectives of the different stakeholders with the hopes to redefine and reimagine empowerment of individuals with special needs.

Going forward

Making Visible How the Various Stakeholders Are Shaping Empowerment of Children (with Special Needs)

When considering the empowerment of children with special needs through their participation in design, Making, and experience of technology, it becomes evident that several stakeholder groups have an influence, which can be either encouraging or limiting. Reflecting back on the empowerment framework and the conditions for genuine participation, we map how the four different stakeholder groups affect each condition, as shown in Figure 2.

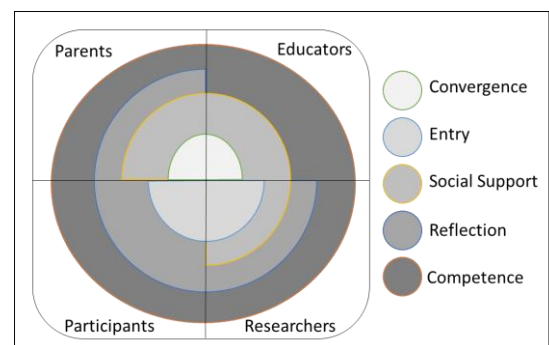


Figure 2: Stakeholder groups and their influence on the five conditions of genuine participation (from the empowerment framework [22])

We maintain that such a mapping is needed in other projects as well. Even if in this case this was done after the fact, contemplation on the variety of stakeholders involved, and on their potential helping and hindering influence on the empowerment of the children should be useful also prior the projects. In such contemplations – either prior or after the projects – one should broadly consider socio-cultural factors involved, shaping the stakeholders. Next, we discuss our findings on the influence of the various stakeholders on the empowerment of the participants. They may act as inspirations for other researchers starting to analyze and reflect on their projects from this perspective.

Stakeholder Groups' Perspectives towards Empowerment

Parents of the children with special needs struggled in our study with balancing socio-cultural image or expectations and acceptance. They had to manage how specific skills, learnt in an intervention, would be utilized outside of the study context, as there were know challenges in

differentiating, or generalizing, between different contexts. They are worried of their children's future and thus explore and question the opportunities available for their child, towards becoming independent and having a meaningful and successful life, after parents are no longer able to support them. The *educators'* focus is in "doing their job" and in achieving the goals set by the school administration. Further, they share similar socio-cultural considerations as the parents. *Researchers* struggle with balancing availability of resources (funding for projects, partners for collaboration), competence (developers or educators for an intervention), and parents', school administration's, and educators' agendas and goals. *Participants* themselves can also have high expectations for what follows after the activities.

When these differing and often contradicting values, goals, and motivations come together, it is challenging to find a common ground. While several findings expressed in this work pertain to challenges experienced by children with special needs regardless of their socio-culture context, it is also important for CCI researchers to examine in more depth what additional challenges pertain to special needs and the cultural context combined together. In our work, and as highlighted in the paper title, innovative solutions towards independence and empowerment of individuals with special needs was met with a lot of resistance from various stakeholders, largely due to prevalent socio-cultural norms.

CCI Research Needs to Acknowledge the Complex Socio-cultural Conditions Shaping Empowerment of Children

We maintain that our findings are relevant for the CCI community more broadly, not only for researchers working with special needs children or in India. Empowerment of children is significant with any group of children located anywhere in the world. There is a number of child groups that can be considered vulnerable, underserved, marginalized, excluded, or disempowered. This study offers insights and a tested framework [22] for advocating their empowerment. Then again, we claim that the insights and framework serve also researchers working in well served contexts – as regards digital technology design, use and Making, there is a lot to be done also in the Global North with ordinary children. In all contexts, sensitivity towards the complex socio-cultural conditions is required. Inclusion and exclusion, voluntariness of participation, social relationships and building of them, distribution and negotiation of power are always delicate matters. Cultural norms and assumptions are also intimately intertwined in any empowerment effort.

Design Implications

We see interesting design implications emerging from the results, on different scales. As for strengthening participation of children with special needs in projects of various kinds, we should consider utilizing or ourselves devising means and tools for the participants to have a voice and a say in the interventions: in their planning, execution, and evaluation phase. The participants should be supported to voice their opinions and views, likes and dislikes as well as experience those being valued, heard and acted upon. Such voice can

entail both verbal and non-verbal communication, including very subtle cues. Significant is not only what is communicated but the resulting experience of being a heard and respected in decision-making processes. Adult proxies may be intermingled with this process as well while their inclusion should be enabled in such a way that overall empowering experience for the participants remains.

We identify design implications also on more systemic level. The close relationships and interactions between the different stakeholders involved in raising a child with special needs provides opportunities to empower the entire socio-cultural ecosystem of children with special needs. We should devise our projects or interventions to seek to support stakeholder aspirations towards technology access, use, and ownership by incorporating technology or goals they deem socio-culturally acceptable, and even desirable, that is, strengthening social status. While this may seem like a radical implication of our work, we argue that researchers advocating for empowerment of marginalized and vulnerable populations, cannot do so without the support of the entire community and eco-system surrounding them.

Limitations and Future Work

One limitation is the missing voice of the other stakeholders besides the researchers. In the future, we aim to extend the discussions to parents, special educators, and participants to understand and map their motivations, goals, and expectations from technology and in the context of empowering individuals with special needs.

CONCLUSION

In this work, we took a critical lens to examine our previous work with children with special needs in India using an empowerment framework. This included three user studies - two interventions aiming to instill entrepreneurial skills, the first through teaching ways to *compost* common kitchen waste that can then be sold as organic-fertilizer within the neighborhood for house gardens, and the second through assembling and selling an energy efficient *solar lantern*. The third study provided a mechanism to practice how to buy groceries from a local store, called *kirana*, in a safe and controlled environment. We contribute to discussions on empowerment of children through design and use of digital technologies. We extend with this study the existing understanding of the strand of empowerment research, which has roots in Nordic welfare states and politically-oriented participatory design, and has addressed neuro-typical children so far, to the context of Global South and special needs individuals. It is very clear, though, that "everything happens in context" [22] - we need to respect the local culture and set our well-meaning studies in the context, asking ourselves: What in this particular study empowers the participants in the best way? Are we this time gathering garbage or going green?

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SELECTION OF PARTICIPANTS

A total 142 participants for the three interventions were selected based on their social, communication, and cognitive skills and the learning goals defined for them for that school year. All the activities in the interventions were scheduled during the participants' school day together with their class teacher, became a part of their regular teaching. Informed consent was obtained when it was concluded that participants understand the activity and its goals and outcomes. Consent from parents or guardians was also taken then. Participation was also renegotiated regularly to stay voluntary. Parents and teachers were regularly allowed to attend the activity sessions, and pictures of the participants were also shared with their parents.

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