

Computational Thinking as Play: Experiences of Children who are Blind or Low Vision in India

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Computational Thinking for Blind Children in India: Challenges

- CT being introduced at primary school level in countries like UK, Japan, Singapore, etc.
- ACM India has designed a curriculum for CT for sighted; inaccessible to blind
- Majority of blind children in India studying in schools for blind
- Teachers teach multiple subjects and majority of them are blind
- Lack of trained teachers and accessible reading material makes CT difficult to be introduced in schools for blind
- Late introduction to computers (~after grade 4) for blind children

Project Torino

- A programming environment developed at MSR Cambridge to teach CT to children with mixed visual abilities
- Consists of different instruction beads and a hub which when physically connected constitute computer programs that generate digital music or stories
- Teachers' guide on how to teach CT using Torino; assignments, lessons and tests
- Demonstrated to be effective in teaching CT in integrated school settings (UK, etc.)
- Commercially available as CodeJumper



Figure. CodeJumper (toy kit and software)

Research Question: *With limited structured teaching and keeping play central, can the Torino model be replicated in India to examine if the children pick up the following skills: Computational concepts: sequence, thread, loop and if-then-else; Computational practice: tracing and debugging and; Computational perspectives: expressing and connecting.*

Ludic Design for Accessibility (LDA): Technology solutions for accessibility have long been created using a narrow utilitarian lens. In our work we follow a new design methodology called the Ludic Design for Accessibility, that puts play and playfulness at the center of all Accessibility design and use.

Torino in India: Play and Playfulness

- Play and playfulness being the central part of the study; based on Ludic Design for Accessibility (LDA)
- **Participants:** twelve blind or low vision participants from three different schools for blind in Bangalore
- **Facilitators:** two sighted facilitators; role was to design, plan and conduct play sessions; design guided play activities for children to learn, ask questions and engage in conversation with children while they played
- **Play group:** two or three participants from same school + one facilitator
- Total 103 play sessions conducted over a period of 2-3 months
- Torino introduced as a toy for creative exploration of music, sounds and storytelling, no mentioning about computational thinking
- Minimal structure and instructions during play sessions in order to encourage participants to play freely and explore features of Torino
- Participants were taught to think aloud while building their programs
- Evaluation done as part of play sessions; based on assessment activities proposed by Karen Brannon and Mitchel Resnick in "New frameworks for studying and assessing the development of computational thinking"

Findings, Results and Future Work

- Participants enjoyed playing with Torino and demanded their favorite stories and songs to be played
- Explored and found multiple toy features not mentioned by facilitators
- Engaged in collaborative play with their team mates to make programs in multiple languages: English, Hindi, Kannada, Tamil and Telugu
- Participants took time learning threads but learned loops quickly
- Participants thinking aloud while building their programs helped facilitators to evaluate their understanding of CT concepts
- Teammates frequently helped each other to debug programs
- Participants frequently practiced program tracing in order to keep track of bugs or connection failures in programs, if there any
- All participants cleared the evaluation tests and play activities for computational concepts, practices and perspectives

Future work includes doing participants' vocabulary transition to CT and introducing CT to teachers of blind students through play using Torino.

