



Industrial Design Project III

Playing kit for Visually Impaired children

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Guide **Prof R. Sandesh**

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Approval Sheet

The Product Design Project -III titled “ **Playing Kit for Visually Impaired Children**” by Sanjay Nair, 08613002 is approved as a partial fulfillment of the requirements for Post Graduate Degree in Industrial Design.

External Examiner

Internal Examiner

Project Guide

Chairman





Declaration Sheet

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/ source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Signature

Name of the student

Roll No.

Date:





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Contents

Abstract

1. Introduction	13
3. Methodology	15
3. Understanding Blindness	17
3.1 Literature Survey	17
3.1.1 Terminology	17
3.1.2 Comparison between sighted and blind child	18
3.1.3 Areas of development affected	19
3.1.4 Perception of the blind child	20
3.1.5 Orientation and Mobility	20
3.1.6 Country of the Blind (Fiction)	22
3.2 Visits to Schools/Organizations/Individuals	23
3.3.1 Smt. Kamla Mehta Dadar school for Blind	24
3.3.2 National Association for the Blind (NAB), India	36
3.3.3 Victoria Memorial School for the Blind	38
3.3.4 Visit to Mehek's home	40
3.3.5 NAB Centre at Thane	44
3.3.6 XRCVC	48
3.3.7 Stay at Pragati Andh Vidyalaya, Badlapur	57
4. Products for blind	65
4.1 Tikk-Tekk Rainbow	66
4.2 Pop-A-Cell	67
4.3 Mayster Braille Loom	68
4.4 Vasantha Braille Cube	68



5. Design Strategy	69
5.1 Deciding the age group	69
5.2 Possible areas of design intervention	70
5.3.1 Vocation (craft)	70
5.3.2 Education	71
5.3.3 Recreation	71
5.3 Deciding area of focus	72
5.4 Inputs for design from research	73
5.6 Context of use:	74
6. Ideations	75
7. Testing	81
7.1 PAV, Badlapur	81
7.2 NAB Centre, Thane	85
8. Final Concept	91
8.1 How it works	93
8.2 Benefits of using the kit	93
8.3 Future scope of the project	97
9. References	99





Abstract

Try imagining the world by closing your eyes as if you have never seen it. Perception of the world is altered drastically when one interprets it through the other senses. Vision is an integral part of our learning process and helps in perceiving the world around us. Children with absence or lack of vision need motivation to explore the world around them. It becomes important for them to engage their other senses more effectively for learning. Many things that the sighted children learn by playing or observing, has to be taught to the visually impaired children. My project involved understanding the world of visually impaired children by looking at existing systems that encouraged exploratory behaviour, researching early childhood education and interacting with individuals linked to the blind community. The research led to prototypes aimed at engaging visually impaired children in play. The objective of the design is to create a playing kit that gives them opportunity to learn through play and exploration while building their various physical, cognitive and social skills.





CHAPTER 1 **Introduction**

I began this project with the intention of designing a product for the blind children in general. My initial approach was to visit one or two special schools for blind children, understand the needs of children in a particular age group and focus my design on a specific area. But after my first interaction with children and teachers at one of the blind schools, I realized that it was not possible to design in isolation. I realized that the project required to be dealt in a more holistic manner. Keeping this in mind, I did not restrict my visit/ interaction to one particular place and started meeting various individuals associated with visually impaired to broaden my horizon about this area.

The research part consumed a significant part of my project duration. Even after I did a fair amount of research there were no direct hints of what the children exactly needed. I had to make my own interpretations of the data to decide what would be the best possible answer to their needs. Though many individuals gave me inputs and feedback to my ideas, the actual validation could only be done by testing the prototypes with the children. I had to take an approach of testing and refining my ideas. My initial idea failed with them but gave a lot of important insights. To finalize my design I went back and had a relook at all the data that I had collected over the time. My research helped me joining the dots and complete the picture for my final design.





CHAPTER 2 **Methodology**

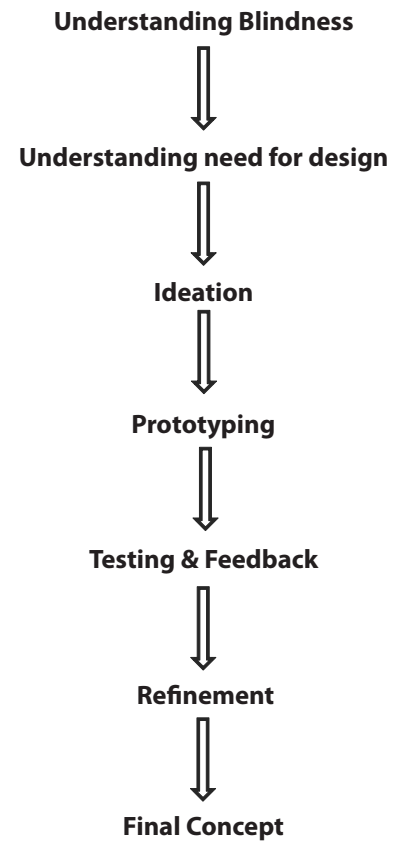


Fig 2.1

Fig 2.1 shows the methodology followed for the project. Though the process was not linear in nature, it has been simplified for representation.





CHAPTER 3 **Understanding Blindness**

This chapter explains the research phase of the project. The research material may be divided into being from two major sources,

- study of the existing **literature** on the subject, and
- visits to schools, organisations and individuals associated with the visually impaired

3.1 Literature Study

3.1.1 Terminology

Blindness : refers to a condition where a person suffers from any of the following conditions, namely:

- Total absence of sight; or
- Visual acuity not exceeding 6/60 in the better eye even with correction lenses; or
- Limitation of the field of vision subtending an angle of 20 degree or worse.

For deciding the blindness, the field of vision as well as visual acuity have been considered.

Field of Vision : It refers to the field which both the eyes can easily see in the front. The normal field of vision is 180 degrees in front of eye. Vision problems related to 'visual field' can mean that the height or width of what a person sees is reduced. This can be like looking through a telescope. Only things which are straight ahead can be seen. Things that are to the side or above or below are no longer seen. Sometimes, there will be blank spots in part of what a person sees.

Visual Acuity : It refers to the ability of the eye to see details. The visual acuity for distance is measured as the maximum distance at which person can see a certain object, divided by the maximum distance at which a person with



normal eyesight can see the same object. Thus a **visual acuity of 6/60** means **that the person examined cannot see, at a distance of 6 meters, the object which a person with normal eyesight would be able to see at 60 meters.** If vision is so impaired that to see the biggest E of the E-chart, the person has to come within 6 meters or even nearer, he is considered blind. The simplest method of testing visual acuity is to see whether the person can count fingers at a distance of six meters.

People with low vision are those who suffer visual acuity between 6/18 to 6/60 in the better eye after the best possible correction."

A low vision individual has significantly reduced vision, visual performance is affected but that there still is vision that can be used. **If there is usable vision, training to use that vision might be possible.** For e.g. use of large print, technology, including optical scanners and digital magnification through closed circuit television.

In **India** a person with a **VA < 6/60 is legally blind**, which enables to receive certain services and financial benefits. However, a person who is legally blind can still have useful vision to do certain tasks. This refers to the fact that they still have functional vision, which is the use of vision for a particular purpose.

Visual impairment is the consequence of a functional loss of vision, rather than the eye disorder itself. Eye disorders which can lead to visual impairments can include retinal degeneration, albinism, cataracts, glaucoma, muscular problems that result in visual disturbances, corneal disorders, diabetic retinopathy, congenital disorders, and infection. The residual vision in case of each disorder is different. Fig 3. 2 and Fig 3. 3 represent what a person with retinal degeneration and glaucoma, respectively, might see in front of him.[1]

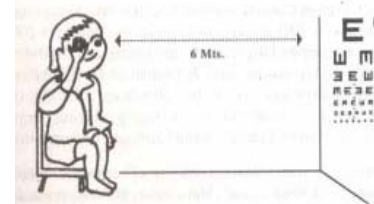
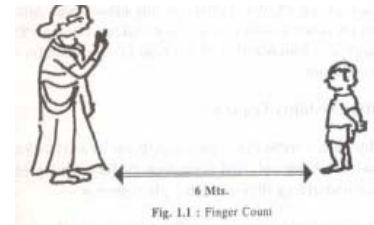


Fig 3.1

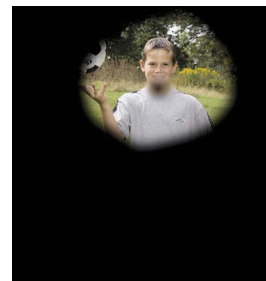


Fig 3.2

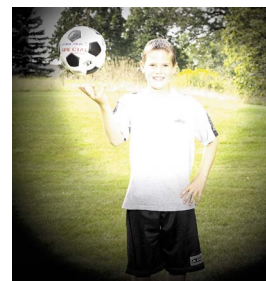


Fig 3.3



3.1.2 Comparison between Sighted and Blind child

Excerpts from 'The Development of Perception and Learning in Blind Children' explaining why there is a learning gap between a blind child and a sighted child of the same age and intelligence:

- For a blind child, developing skill in **effective use** of the **other senses** is prerequisite for any further learning.
- A **sighted child** of same age and intelligence begins to use these skills for more **complex learning**.
- Eventually blind children develop skills but only with great expenditure of **time and effort**.
- Specific **deliberate training** in the perceptual skills becomes necessary from a very early age to minimize the learning gap between blind and sighted. [2]

3.1.3 Areas of development affected

Motor skills

Poor vision may decrease the baby's **ability to explore** in the important first twelve months of development. This may mean that it takes longer for a child to crawl or walk. [3]

Sensory Development

This refers to the development of the senses of touch, hearing, sight, smell and taste. Sometimes, a person who has vision impairment may be **frightened by new experiences** involving different textures or sounds.

When a child can not access his world efficiently through his vision, he must learn to use his other senses more effectively. **Systematic instruction** is needed to develop the other senses for use in travel and finding things in the environment. He must understand that some of the sounds and smells and textures he experiences can be used as permanent markers (landmarks) to let him know where he is in the world. [3]

Communication and social skills

Many conversations begin when people make **eye contact** (look each other in the eye) or use some type of signal, such as a welcoming smile or a wave. People who have vision impairment may not always recognise our efforts to communicate with them because they may **not be aware** when we are looking, smiling or waving at them. People may need to work out ways of getting their attention by **sound or touch**. [3]

Self-help skills

Children who have a vision impairment **will not notice and copy** what others are doing. Therefore, self-help skills may be **slower to develop** and may require specific teaching. Fine motor skills to manage buttons, laces and zips may need more practise. [3]

Spatial concepts

Our joints and muscles give us **feedback about** where our **body parts are positioned**. This is called **proprioceptive sense**. Proprioceptors located in the muscles and joints tell us if we are slumping or standing up straight, if our fingers are curled or extended, etc. The vision system and



proprioceptive system work closely together. When **vision is impacted, so is the proprioceptive sense**. Children with visual impairments generally need help to learn where their bodies are in space, and in relation to things in the environment. [4]

Independent movement

Independent movement is tied to growth in other areas, such as **communication and socialization**. For example, though a child may not be able to tell if he's hungry, if he can take you to the kitchen you will probably understand that he wants something to eat or drink. Peers are more likely to invite a child to go to a place if he/she can keep up with the group by using a sighted guide or traveling with a cane. Going where we want when we want gives control and allows the person to make his/her choices.[4]

Learning new concepts

There is a **limitation** of the range and variety of **concepts** a visually impaired person can **learn on his/her own**. For the adventitiously visually impaired person, there is **difficulty in updating concepts**, such as technological developments, fashions and fads, and environmental changes. This loss is a major problem **affecting** most aspects of the **congenitally blind person's** life because the development of concepts is the foundation of **academic, social and psychomotor learning**. [5]

3.1.4 Perception of the blind child

- It is very **important** for the children to **move about and explore** which in turn form **perceptions**. New perceptions lead to new **concepts**. **Cognitive skills** are built upon perceptions and concepts; there is a connection between self-directed movements and the development of sophistication.
- blind child must **replace visual percepts** with a combination of sensory inputs from the **remaining senses**. These **nonvisual sensory inputs** can only be gathered if the blind child moves through space and **actively researches spatial relationships**.

There is a demonstration used by trainers from the High Scope Foundation (an independent non–profit research, development, training, and public outreach organization) that shows teachers how concrete instructional approaches are superior to other “traditional” educational practices. This demonstration is even more significant for blind children and their teachers. The high scope trainers explore the teaching of the **concept “apple.”**

- A card is passed around the room. On the **card** is the word “apple” is **written**. Teachers are asked what this word tells them about apples. **Not much is learned** from the written word, yet many blind children live in a world where the word is all they know about many concepts.
- Next, a picture of an apple is passed around. Again the teachers are asked what the **picture** tells them about apples. More than a word, but not much more. Blind students can be very articulate in their descriptions, giving the impression that they are highly aware of their environment. Yet these students may have a **shallow understanding of concepts**.
- Next around is a **plastic apple**. Now teachers report **shape and color**. Models are useful tools, but they have **limited conceptual value**, especially for blind children. The cognitive leap between simulation and reality is not always made. Blind children need to **explore the real world**.
- Next around is a basket filled with **real apples** to be felt, cut up, smelled, and tasted. Here is a concept that has strength; a **multi-sensory experience** that is honest and has staying power. Traveling to an orchard to explore apple trees and eating the fruit right off the tree is an even better educational experience. [6]

3.1.5 Orientation and Mobility

Orientation and mobility becomes important for a visually impaired individual as these do not happen by default as in case of a sighted person. In the subsequent sections I've elaborated the following:

- What is Orientation & Mobility (O&M)
- Roles and responsibility of an O&M instructor
- Strategies for teaching O&M



What is Orientation & Mobility:

Orientation and mobility training (O & M) helps a blind or visually impaired child know **where he is in space** and where he wants to go (orientation). It also helps him be able to carry out a **plan to get there** (mobility). Orientation and mobility skills should begin to be developed in infancy starting with basic **body awareness** and **movement**, and continuing on into adulthood as the individual learns skills that allow him to navigate his world efficiently, effectively, and safely.

Orientation and mobility **training** actually began **after World War II** when techniques were developed to help **veterans** who had been **blinded**. In the 1960s universities started training programs for **Orientation and Mobility Specialists** who worked with adults and school-aged children. In the 1980s the O & M field recognized the benefit of providing services to preschool-aged children. Today, orientation and mobility specialists have developed strategies and approaches for serving increasingly younger populations so that O & M training may begin in infancy.

Skills taught through O&M

- **sensory awareness:** gaining information about the world through hearing, smell, touch and proprioception
- **spatial concepts:** realizing that objects exist even if not heard or felt, and understanding the relationships which exist between objects in the environment
- **searching skills:** locating items or places efficiently
- **independent movement:** which includes crawling, rolling, walking, etc.
- **sighted guide:** using another person to aid in travel
- **protective techniques:** specific skills which provide added protection in unfamiliar areas
- **cane skills:** use of various cane techniques to clear one's path or to locate objects along the way [7]

Roles and Responsibilities of an Orientation & Mobility Instructor

To teach mobility

Orientation and mobility specialists teach blind children to move through the world without getting hurt, without hurting others. The term "mobility" refers to the techniques and devices that are used to keep blind and visually impaired students safe while they are moving. Successful mobility also implies that the blind traveler is efficient, as well as safe; ie. does not go too slowly or inappropriately fast.

To teach orientation

To be oriented means to know where you are in space and, therefore, how to get from one place to another without getting lost. A good understanding of spatial concepts is essential. Good orientation also involves using the intact senses to identify landmarks. Blind children need to learn design layouts (bathrooms have one layout, kitchens another) as well as learn specific routes.

To reduce stress

Movement through space without the use of vision can be very stressful. It is the responsibility of the mobility specialist to design lessons to minimize anxiety, and to teach strategies for reducing or managing stress while traveling.

To be a role model

Mobility specialists often work with school age blind children for all of a student's public school experience, and for most of the instructor's career. The mobility teacher is therefore a primary role model in the blind students life. The mobility specialist's attitude and character are extremely important. [8]



Strategies for teaching O&M

Orienteering

Orienteering is the process of learning environmental patterns, most of them man-made spatial patterns (the built environment). It often involves **learning strategies to move efficiently through specific building layouts**. Malls, grocery stores, residential areas, and so on, have logical designs. Knowledge of layout leads to competence when traveling.

Landmarks and Clues

Landmarks are chained together to teach **routes**. This is the strategy used to teach orientation to blind children. It is a system that is equally useful for **teaching travel skills** to other children in special education, particularly those with perceptual and/or vision anomalies.

Walking Behind

Mobility specialists are careful to walk behind their students. Walking ahead or beside allows the student to follow. It takes away the responsibility for self orientation. Mobility specialists do walk ahead when they are requiring students to follow the sound of a moving voice.

Fading

During beginning lessons, students stay close to their teachers. There is constant **feedback and assistance**. This **builds confidence** and **overcomes insecurity**. As students develop, mobility instructors fade their assistance. They give less help and provide less verbal feedback. The distance the instructor is from a student also increases with student ability (the teacher fades into the background). Final lessons occur with the instructor out of sight and the instructor is no longer available to them unless an emergency occurs.

Feedback

Mobility instructors use basic teaching strategies like **positive feedback** and **prompting**. Student questions are rarely answered directly. Instead, the teacher prompts the student to problem solve on their own or with the help of teammates.

Reorientation

Mobility specialists believe in letting students “get lost.” At a high level

of independence, students are allowed to wander while they attempt to reorient. The students understand that they are to solve their own problems. If instructors intercede it is only to suggest strategies for problem solving.

Independent Lessons

After students have mastered a set of lessons (or a layout), they are allowed to go on independent lessons. During these lessons teachers are out of sight and may not interact with students until the lesson is over. “Drop off sessions” are tests that show the student and the teacher that routes or layouts have been learned. [9]

3.1.6 Country of the Blind (Fiction)

Author

Herbert George Wells

Plot

In this tale a mountain climber falls off into a strange and isolated world which is inhabited by blind people who claim to have been in existence for about 15 generations and cut off from the rest of the world by an earthquake in the early years of founding. **The intruder remembers an old rhyme and quickly decides that “In the Country of the Blind, the One-eyed Man is King.” However, his attitude seems wrong in a society which no longer knows the meaning of the word “see” and still operates perfectly, effectively and happily with their other senses tuned sensitively.** Virtually imprisoned and relegated to serve them, the interloper begins to learn living with his disability - his sight. Eventually he falls in love with a woman. He gains the permission to marry her only if he is willing to abandon his eyes, which are deemed the cause of the irrational outbursts which occurred in the beginning of his ‘imprisonment’, and have them removed. When he finally has to choose between his love and one of his most important senses, his sight, he chooses the latter one and decides to break out.

Interpretation

The whole story is a reversal of the idea of disability which shows us that the circumstances alone define the word disability. **The experience of being an alien seems to be the major point of this story.**



The visitor first thinks that he has got an advantage over the blind people, remembering an old phrase: “In the Country of the Blind, the One-eyed Man is King,” but his advantage turns out to be in fact a disadvantage. [10]

Applying this analogy to myself, I was an outsider in the world of the visually impaired people. Understanding their world was very crucial to make something that would be relevant for them.

3.2 Visit to schools/organizations

After literature study my next objective was to start meeting visually impaired individuals. Following are the places I visited in the duration of my project:

- Kamla Mehta School for the Blind, Dadar
- Victoria Memorial for the Blind, Tardeo
- National Association of Blind (NAB), Worli
- Mehek’s Home
- NAB Centre for Visually Impaired Children, Thane
- Xavier’s Resource Center for the Visually Challenged (XRCVC), Fort
- Pragati Andh Vidyalaya, Badlapur

There are 4–5 schools in Mumbai dedicated to the blind. I contacted the schools but not all were willing to let me interact with the children mainly due to their internal policies or the fact that most of the children were appearing for their exams during that period.

I got permission to visit Kamla Mehta School at Dadar after explaining the purpose of my visit to the school principal Smt. Swati Tendulkar.



3.2.1 Smt. Kamla Mehta Dadar school for Blind

Kamla Mehta Dadar school for blind is a **residential school for blind girls**. Set up originally by American Marathi Mission to serve the children blinded by the Sholapur famine at the turn of the century, this school has since been catering particularly to blind girls even from beyond Maharashtra [11]. The children who stayed nearby visited their homes on weekends, others went during vacation.

I chose this school for my first visit as some students from the previous batches had done their project research over here. The principal of the school, Smt. Swati Tendulkar informed me that I could meet only the **pre-primary children** as examinations were on for the older children. The duration of this visit was short which lasted for an hour. I did not interact with the children, more because of my own apprehensions. But I got an overview of the nature of activities that children between 4-6 yrs did in this particular school.

The teacher in charge of the class, Smt. Madhuri showed me around the **activity room**. **Fig 3.4** shows the children in the room. There were **5-6 children** in the room with different **levels of visual impairment**.

From outside, this looked like any other classroom but a closer look revealed the differences. The **activities** that the children did over here were very different from what sighted children of same age group did. In the following sections I have explained various observations and inferences that I made during the visit.

Fig 3.5 shows their daily time-table that was displayed on the wall for the teacher's reference. Following section elaborates the **meaning of various**



Fig 3.4



इयत्ता-ब्रेल वेळापत्रक सन २००९-१०					
क्र.	सोमवार	मंगळवार	बुधवार	गुरुवार	शुक्रवार
१.	मुक्त हाथ्याली	द्यान्य निवडणे	द्यान्य निवडणे	लेखन/वाचन	मणीकाम
२.	श्लोक/वाचन	नृत्य/मो./पाढे	गणित	नृत्य/मो./ले.	गणित
३.	पाढे/लेखन	इंग्रजी	गणित	इंग्रजी	गणित
मोठी - सुट्टी १२.३० ते १.१५					
४.	मुख्यशिक्षण	लेखन/वाचन	सामान्यज्ञान	सामान्यज्ञान	स्पर्शज्ञान
५.	पाठान्तर	लेखन/वाचन	दैनंदिन को.	पाढे	स्पर्शज्ञान
६.	गोष्ट	हातकाम	हातकाम	गाना	इंद्रिय कौशल्य
छोटी - सुट्टी ३.०० ते ३.०५					
७.	शा.शि.	पाठान्तर	शा.शि.	गार्डन/खेळ	संगीत
८.	संगीत	गाना	संगीत	गार्डन/खेळ	शा.शि.
९.	खेळ	कॅसेट	सा. कथायत	हातकाम	कॅसेट

Fig 3.5

activities mentioned in the time-table.

Mukta Haalchaali Body awareness by free movement of body parts

Dhaanya Nivadne Discrimination of seeds, spices etc. on basis of size, shape and texture

Mani kaam Inserting beads into thread

Sparsha gyaan Object sorting & matching, exposure to different textures

Haath Kaam Art and Craft activities (clay,paper, colouring)

Indriya Kaushalya Activities to improve different sensory perceptions

Sangeet/Nrutya Musical instruments and Dance activities

Gosht Story telling

Shaaririk Shikshan Physical Training

Lekhan/Vaachan Reading and writing (Braille)

Ganit Mathematics

Paadhe Counting, multiplication tables

Cassette Listening to recorded audio tape

Paathantar Learning by memorization

Gaani Singing

Khel Playing in garden/ doll house/ with toys

Saamanya Gyan General Knowledge



Fig 3.6 shows the various **craft items** that the children have made by origami.

- Through this activity the children learn to **manipulate** paper to create different objects like boat, house etc.
- The teacher explains them how to make these objects by making them **feel the shape** of the paper at **each step**.
- The children **memorize** these **steps** to make the object themselves.
- This activity helps them **improve** their **fine motor skills** as well as their **memory**.



Fig 3.6

Fig 3.7 shows a craft activity in which the child has made a house and a sun.

- In this activity the children are given the cutouts of different shapes and the have to stick it to the paper to represent different objects. In this case a house and the sun have been shown.
- Through this the children learn about different **geometric shapes** and how these shapes can be **abstracted** to represent different **objects**, especially those that are difficult to explain by actual touch.
- Also use of different **texture paper** for different shapes teach them to **discriminate** between **shapes** and **textures**.
- **Bright contrasting colours** have been used making it easier for the **low vision** children to discriminate between shapes.



Fig 3.7

Fig 3.8 shows a colouring activity in which the child has represented a tomato.

- **Colouring** activity is done only by children with **low vision**.
- In this activity the teacher makes the **border** of the object to be coloured with a **black thread**.
- The child can feel the **raised surface** generated by the thread, while black colour gives **high contrast** w.r.t the white background, making it easy for **identification**.
- The colouring activity also helps the teacher know how much the child has **understood** about a **particular colour**.

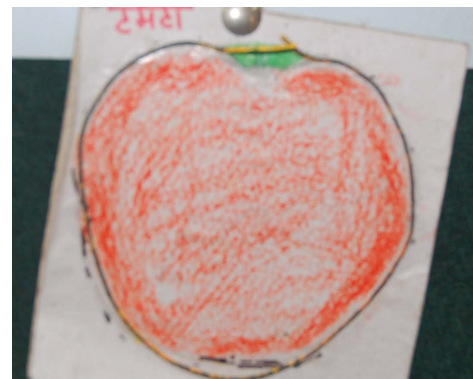


Fig 3.8



Fig 3.9



Fig 3.10



Fig 3.11

Fig 3.9 shows the teacher explaining different products meant mainly for and improving fine motor skills and for sensory development

- Behind the teacher is a cupboard where different products specifically meant for this purpose are kept.

Fig 3.10 shows different types of seeds kept in a container.

- This activity teaches the children how to **discriminate** between **objects** on basis of **shape, size, texture, smell** and **name them correctly**.
- As far as possible **real objects** are taken and children are taught about the different characteristics of the object. For e.g. what characteristics makes seed a seed.
- This activity is also done for different kinds of vegetables, fruits, spices, coins, notes etc.
- Wherever real object can't be used **scaled models**, toys are used e.g. animals, buildings, aeroplanes, ship etc.

Fig 3.11 shows bottles having substance of different odours

- As mentioned earlier smell can serve as identification markers for particular things, places etc. so it is important for the child to develop his/her **olfactory perception**.
- In this activity the child is exposed to **different types of odours** and explained by giving name to each one of it.



Fig 3.11 shows wooden board having different key slots.

- The objective of this activity is to develop the touch perception and learn to **discriminate** between **shapes**.
- The children have to **match the key** to the correct slot after feeling its profile.
- The key will fit in the slot only if the profile of the key and slot match. Thus the child gets **feedback** whether he has placed the key correctly or not.
- This is an activity in which they **apply their knowledge** of shape discrimination that they learnt in previous activities e.g. discrimination of seeds on basis of shapes.
- This **product** was not available in market and was **specially made** for the visually impaired children.



Fig 3.11

Fig 3.12 shows a black thread and textured beads kept in a bowl.

- This activity requires the child to put the **beads into the thread** correctly. The bowl is used to store the beads.
- The **objective** of this activity is to **improve the fine motor skills** of the child.
- Fine motor skills involve the **small muscles of the body** that enable such functions as writing, grasping small objects, and fastening clothing. Fine motor skills involve **strength, fine motor control**, and **dexterity**.
- The beads are textured, brightly coloured, and of large size so that the low vision and totally blind child can easily identify them. **Black** coloured thread is used to create **contrast** with the bead.
- The side benefit of this activity is that the child also learns to **count numbers**.



Fig 3.12

Fig 3.13 shows a child inserting beads into thread.

- This activity is same as the previous one and the objective is also same. i.e. to improve the fine motor skills of the child.
- The child shown in picture is around **6-7 yrs old** so the level of **complexity** in this activity is **higher**. i.e. the thread is finer and the beads are smaller.
- This task helps her to learn **further complex activity** like stitching and sewing.



Fig 3.13

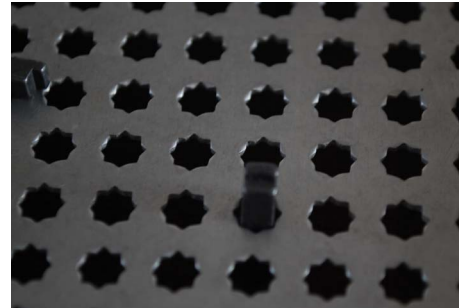


Fig 3.14



Fig 3.15

Fig 3.14 shows a Taylors frame

- The Taylors frame is used for teaching **mathematics** to children.
- The **frame** consists of an array of **star shaped octagonal holes**.
- A **square peg** with raised surfaces on both sides fits in the slot. The **alignment of the peg** decides whether it's a number or a mathematical operator.
- They use this frame to learn **counting** and other mathematic operations like **addition, subtraction, multiplication and division**.
- Some schools also use **Abacus** to teach Mathematics
- Teaching was done on a **one to one** basis.

Fig 3.15 shows a child using Taylor's frame

The teacher explained me how they learn using the frame:

- The first thing that they learn to do on the frame is to **align the pegs in straight line** one below the other.
- Then they learn to **relate** the alignment of the peg to number that it represents.
- Once they understand the number represented by the alignment of the peg they learn to **count** on the frame. In this way step by step they go on to learn further complex calculations.
- The teacher told that it takes **more time to teach** these concepts to **totally blind children** compared to low vision children and that each child needs a different level of guidance.
- I **observed** that the children finding it **difficult to use this frame** and were taking time to figure out the alignment of the peg. The teacher told that learning through the frame is difficult initially but don't face a problem once they get used to it.
- The low vision children try to use their **residual vision** to perform these activities. They have to **bring their eyes very close to the frame** so that they can see it.



Fig 3.16 shows a child reading Braille

- Braille is taught after the child develops his/her fine motor skills and sensory perception of touch to perform various activities mentioned earlier in the report.
- Initially it is explained to the child that **braille** is based on a **sequence of cells made up of six dots** that are arranged to form letter, words, sentences and paragraphs.
- They are familiarized with the braille lines by making them **move their finger** over it.
- Then they are taught **phonetically** by introducing braille letters one at a time and going over its sound.

Fig 3.17 shows a child use braille slate and stylus

- The **slate and stylus** is the blind person's equivalent of a pencil and this form of convenient access to writing braille is as essential to blind people as writing with a pencil is to sighted people.
- It is the cheapest technique to learn Braille.
- A slate and stylus is a small, mechanical device used for writing braille by hand. Typically, a braille slate is a desktop two-part hinged device. The top part contains rows of rectangular openings corresponding to individual braille cells which guide the stylus while the bottom part has rows of indentations arranged in cells allowing the stylus to emboss dots on paper. A stylus consists of a small handle made of wood or plastic with a sharp metal point.

Fig 3.18(a) shows the hinged part and the stylus and Fig 18(b) shows a magnified view of the rectangular openings.

- Writing on a braille slate is done by inserting paper between the top and bottom parts of the slate and inserting the point of the stylus through the openings in the top part, pressing the paper into the depressions below.
- The braille characters must be formed from right to left on the backside so that the person can read from left to right when the paper is reversed.
- **Compared to a pencil and a paper the time and effort required to write here is much higher.**



Fig 3.16



Fig 3.17

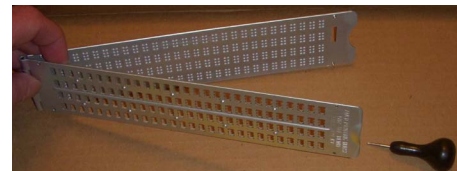


Fig 3.18 (a)

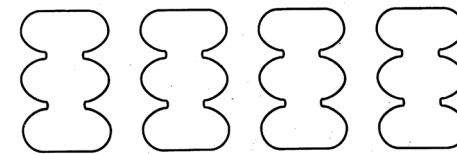


Fig 3.18 (b)



Fig 3.19



Fig 3.20

Fig 3.19 shows an activity in which the children have to identify alphabets which are placed like fruits on a tree.

- The **fruits** represent different **alphabets** of 'Marathi' language. The alphabet is indicated by **painting** as well as a **braille sticker** so that its easy for the low vision and the completely blind to identify them.
- The tree has hooks on which the fruits are hung at different positions randomly.
- The teacher/child tells to **identify** a particular alphabet and the other child has to **search through the tree** and **locate it** correctly.
- The children seemed to **enjoy playing** this as there was an **uncertainty** about the position of the alphabet and a **reward** of finding the alphabet in form of fruit.
- While this task is fairly **easy for a sighted child**, its challenging for the the visually impaired as they have to search it using their sense of touch.
- This activity helped them learn Braille and also brought about movement of different body parts thus improving the **kinesthetic sense**. **Kinesthetic sense is the ability to feel movements of different parts of body.**

Fig 3.20 shows a three children sitting on a bench in the premises.

- These children **walked in group** which seemed to give them a sense of **security**.
- They walked very **slowly** and the child having better vision seemed to guide the other two.
- One of the girl was talking to the other two, but her head was not facing towards them, suggesting that she was **not aware of her friends' exact position in space**.



Fig 3.21 shows the 'doll house' from outside and Fig 3.22 shows three children and along with their teacher inside the doll house.

- Apart from playing with dolls as the name suggests, the doll house had a **miniature kitchen** model where the children were taught about various activities performed in the kitchen. They would **mimic** the **actions** of their **mother/maid** inside the kitchen.
- The **teacher** attending them was **blind** herself. Some of the children were aware of her presence and communicated with her whenever they needed something.



Fig 3.21

Fig 3.23 shows two children inside the activity room

- I observed that one of the child was **moving around in circles** continuously and another child was sitting on chair.
- The teacher told me that they do this to **release the excess energy** that is stored in them due to lack of physical activity.
- There was a possibility of tapping this energy to do something more creative e.g. dance
- They **didn't seem to be aware** of each others presence which prevented them from interacting with each other.



Fig 3.22



Fig 3.23



Fig 3.24



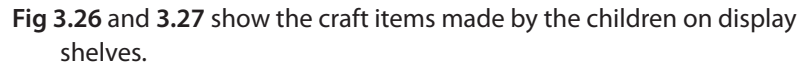
Fig 3.25

Fig 3.24 shows different kind of toys stored in the display shelf.

- There was a **wide range of toys** in the room. **Toys** had an advantage that they **can be used** across a **wider age group**. There were different types of dolls, cause and effect toys, e.g. spring wound and battery operated ones.
- The teacher told me that these toys were same as that used by the sighted children and there was **no** particular **toy** that was **specially made for visually impaired children**.

Fig 3.25 shows the child indicating the toy she wanted to her teacher.

- The children seemed to **know the position of their favorite toys** in the shelves and would **ask their teacher to remove it** by pointing out correctly.



- Fig 3.28** shows the magnified ceramic flower vase and roses made out of paper.

- The roses looked finished which suggested that it was easier for them to **make things** which had a **procedure or pattern**.

Fig 3.29 shows a girl weaving a jute bag

- The level of detail in the product was very high and it looked as if a person with normal sight had made it.
- This was possible with high amount of **practice** and **attention**.
- The learning starts with making a basic braid. This **pattern was repeated** to form the final product.





Fig 3.27



Fig 3.28

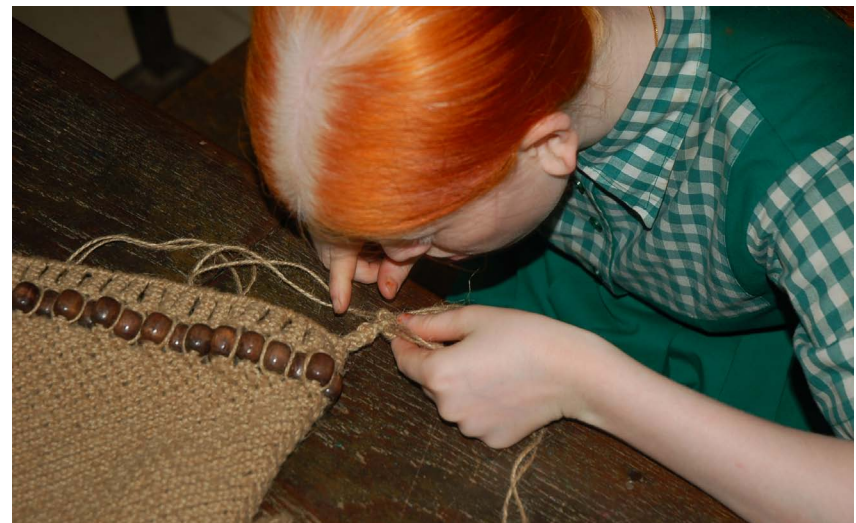


Fig 3.29



3.2.2 National Association for the Blind (NAB), India

The principal of Kamla Mehta Dadar School was of the view that I should meet Mr. **Shankar Raman** of NAB for further guidance. Mr. Raman was head of the **education department** at the NAB and was partially sighted himself. He explained me the role of NAB in the education of the visually impaired and gave me inputs on my project.

Fig 3.30 shows the building of NAB located in Worli (Mumbai). NAB was established in the year 1953. It is involved in various activities that supports the cause of blind people.

Mission

- To prevent blindness as far as is possible.
- To empower the blind with education and training, towards self-sufficiency through employment or self-employment and thereby **integrate** them with **dignity** into the mainstream of **society**.

Vision

To work towards an environment where each and every blind person of this country will be able to lead a life up to his **optimum potential** and be so empowered as to be able to work towards his **own growth and development**.
[12]

In the early part of the last century, education of the blind was carried out through **special schools**. In the most part, these children stayed there and got educated. They were also taught elementary trades which would lead them to some kind of vocational rehabilitation. However, **not much could be achieved in this way**. Hence, from early 60's, the idea of **integrated education** started to be implemented.



Fig 3.30



Integrated Education

Integrated education implies that blind children are admitted in **regular schools** and a **Special Teacher** is appointed in the ratio of 1 teacher for 8-10 students. This Special Teacher acts as a **facilitator** between the **blind student**, **regular teacher** and the **family** of the student. The teacher **visits** the students at least **twice a week** and teaches his/her **curriculum** in medium such as Braille, Taylor's Frame, Abacus etc.

This activity of the Department has enabled many blind children to get access to education in the nook and corner of the country. In the year 2007-08 this activity benefited 835 students (486 boys and 349 girls) in of 534 villages of 9 states.[13]

Inputs from Mr. Shankar Raman

- According to him **education** is the **primary focus** for most of the **research** done for the blind and that **recreation** was one area that was **neglected**. There were very **few options** available for recreation, especially for the children. Due to this reason they often faced **boredom**.
- Any project in this area would require a lot of **research**, especially related to education. He argued that due to the **complexity** involved, most of the output would either be unfinished or at **concept level** and were not executed due to various reasons.
- One of the reasons why many people were not willing to do projects in this area was that it was **not monetarily beneficial**.
- Recreation was one area which was not explored much, and there was lot of scope for design in it.
- He also felt that I should take up a project that can be **finished** in the given **duration**.



Fig 3. 31



3.2.3 Victoria Memorial School for the Blind

The Victoria Memorial School for the Blind is a charitable institution dedicated to the education and rehabilitation of the blind. Founded in 1902, to commemorate the memory of Queen Victoria, the school has not just been offering free education to children with visual impairment for over 100 years, but also nurturing them to grow up to be responsible and self-supporting citizens. The students, many of whom are completely blind, are mostly from rural areas, belonging to disadvantaged families. Fig 3.32 shows the school building. The school offers the following facilities:

- **Free** education, board and lodging, endeavouring to look after the students' varied **physical** and **psychological needs**.
- Education in the Marathi medium as well as training in various **crafts** and **vocations**, from pre-school to middle school levels.
- After the seventh standard, the children continue to enjoy hostel facilities, but are admitted into regular school for an opportunity to integrate with sighted children.[14]

My objective in this visit was to interact with **older visually impaired children** and understand more about their lives.

The principal of the school Smt. Shamal Chauhan gave me permission to visit after the school hours, as the children were having their examinations. I wasn't given permission to take photograph or record at this school, so I have documented the important points that came out of the conversation I had with the children.

I went to the garden where some children were walking around the place in small groups. Initially I was apprehensive about interacting with the children as I didn't know how they would react. I took their **caretaker's help** to get myself **introduced** to them. But I realized that my fears were unfounded. I started casual conversation with **2-3 children** who were **10-12 yrs old**. Other children then joined us out of curiosity. The interaction with them lasted for around an hour and these are some of the things they told me.



Fig 3.32



- All the children I met felt very **secure** in the **school environment**, some even preferred being at school compared to home.
- Children who went home on weekends did **not** have **many friends** amongst **sighted** children and they preferred to be at home. They kept themselves engaged by listening to **television** and **interacting** with **family members**.
- They were very open to interacting with the sighted people while the reverse was not true. I realized this through my own experience.
- Their sense of **spatial orientation** within the premise was very **accurate**. They took me around the premise and described different places by pointing in the correct direction.
- **Cricket** was their **favorite sport** which they played with audible ball. They had inter-school cricket matches also. But this was the only game that they played and they would **get bored** of it sometimes.
- Apart from cricket, the other physical activities they did was **Yoga** and **Mallakhamb**.
- **Recreational activity** also included learning **musical instruments**. Though many children liked listening to music **not all** found it easy/interesting to **play** the **instruments**.
- **Touching** and **feeling** gave a sense of **security** to them. One of the children held my hand throughout the time I was interacting with them.
- They **overcame** the **fear** of experiencing new situations by **facing** it. For e.g. they told with pride about the incident when they successfully trekked a nearby hill.
- They were very **inquisitive** and very keen to know about the world around them. They inquired about my likes and dislikes, the place where I come from and what I'm studying.
- Some of the children told that they **studied in groups** and would help each other whenever anybody finds it difficult to understand a particular concept.
- **Television** was the **main source of information** about the outside world.
- One of the child was good at **imitating actors** and **news anchors**. The children were amused when he imitated the news anchor.
- **Size and proportion** of unknown objects were taught either by **directly** making them feel it or by **relating** it with other objects for e.g. height of elephant was taught to them by relating it to the height of the wall.



3.2.4 Visit to Mehek's home

Through NAB, I got in touch with Smt. Mrunal, who was a special teacher for the suburban areas. She told me that she would be visiting Mehek's house and asked me to come over there.

Mehek is five years old and has **low vision** from birth. Her parents enrolled her into the 'integrated education' program at NAB when she was four years old. Now she attends a local school in the vicinity along with sighted children. The special teacher attends her house twice a week and teaches her curriculum through Braille and Taylors Frame.

The objective of this visit was to **understand** how education through **integrated education** different from that at **special schools**.

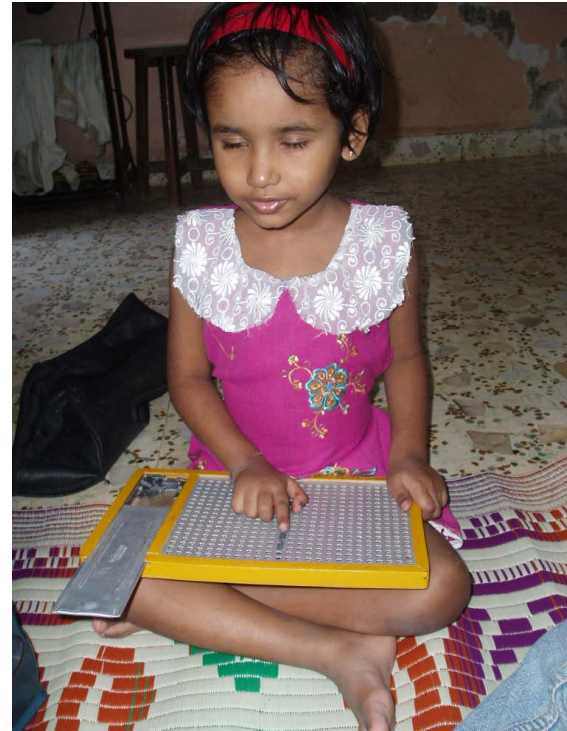


Fig 3.33



Fig 3.34

Fig 3.33 shows her doing Maths on the Taylor's frame.

- She had low vision but **relied** on her **perception of touch** to do **counting** on the Taylor's frame.
- She was able to count numbers through the tailors frame (up to 100). She could add and subtract single digit numbers, again through the frame. But **mental calculation** was **difficult** for her.
- Counting numbers backwards was another area of difficulty.

Fig 3.34 shows her typing Braille on the Perkin's Brailier.

- She had learned all the alphabets of English and could type all the letters on the **Perkin's Braille typewriter**.
- Connecting letters to form words was something she was still trying to learn. **Meaning of words** was **taught** to her by **narrating stories**.
- The teacher added that learning **Braille** initially is difficult for the children and sometimes **boring** too, but they don't have a problem once they get a hang of it.
- Her **attention span** was **short** and it was **difficult to keep her engaged** in the same activity for more than 10-15 min. For e.g. although the teacher claimed she knew to type all the alphabets on the typewriter, she kept on making mistakes towards the end and made no effort to correct herself.
- Sometimes the teacher would scold her if she repeated mistakes.



- Unlike Math and English she showed **more interest in coloring activity**. The tasks involved matching objects by connecting lines and coloring simple **geometric shapes** and **objects having multiple colors**, for e.g. house, tree etc.

Fig 3.35 shows the teacher drawing outline for the colouring activity

- All the **outlines** of the objects to be colored were done in **black** to create a high contrast and making it easier for her to color inside the boundary.

Fig 3.36 and 3.37 show her doing the colouring activity

- She found it **difficult to differentiate between colors** even by keeping it very **close to her eyes**.
- Also, the **judgement of color** was **affected** by her **perception of the real object**. For e.g. the tree that she colored was fully green in color. She was not aware of the fact that the tree bark is brown in color and this had to be explained to her.



Fig 3.35



Fig 3.36



Fig 3.37



Fig 3.38



Fig 3.39

Fig 3.38 shows her playing the game 'Match It'

- When asked about the activities she would do in her free time, she told about the game '**Match It**', in which the **shapes** had to be **matched** and put in the respective holes in a minute's time (measured by sandglass).
- She was able to do put the shapes in the respective slots but could not get the visual feedback through the sandglass.
- While playing she **relied both on her vision and the perception of touch**.
- The shapes and the background had **bright contrasting colours** due to which could **identify the pieces** but to understand the profile she used her perception of touch.
- Her teacher told that she had **memorized this game** due to repeated play and **didn't find it interesting** anymore.

Fig 3.39 shows pieces of a construction kit

- Her teacher mentioned that interlocking the pieces helped in improving her fine motor skill.

These were additional things that the teacher told me about her:

- She would **remain idle** or **move around in circles** when she was left to herself as there were **not many options for recreation**.
- Her **friend circle was very limited** and normal sighted children of her age would not include her for playing as **she couldn't catch up** with them. She was of the opinion that this would change over time and her friends would be more sensitive as they grow older.
- Her younger brother was her constant companion, be it playing, sharing or fighting. This sensitivity was developed as she was staying with him at home and not at a residential blind school.
- The teacher added that compared to a special school the **development rate of the children attending normal school is slower initially**, but has the advantage of the child being at home and getting used to live in the world of the sighted.



3.2.5 NAB Centre at Thane

The NAB centre operates on the weekends and has four-five teachers attending to various needs of the visually impaired children. The centre offers the following facilities:

- **Play based activities** for improving **sensory and fine motor skills**
- **Toys** for recreation
- Basic **computer** facility
- Additional **training** for children facing difficulties in a particular area
- **guidance to parents** related to visual impairment of the child

After interacting with the children my next objective was to try and understand more about their perception of different kind of objects.

The objective of this visit was to study how the blind children perceive the toys and other objects. The objects that I took were categorized as follows:

- **Construction toys:** Lego, MagWeb
- **Figurative toys:** Dolls, Action figures, stuffed toys, Animals, vehicles etc.
- **Objects:** Geometric shapes, stones, marbles

I intended to give them the toys one by one and **study** the the following:

- **Level of interest** the toy aroused
- **Assistance required** to play with the toy
- **Time** for which the child was **engaged** with the toy
- Child's **perception** of the toy
- **Learning** from the toy

Although intention was to give the toys to the children and let them interpret it independently, the environment of the centre did not allow this. Each child was accompanied by his/her guardian, and the children were being taught/trained by the teachers during their time at the centre. Also, the children were of different ages and different background so the nature of feedback would be different for each child. Following are the things that I observed/learned by interacting with them:

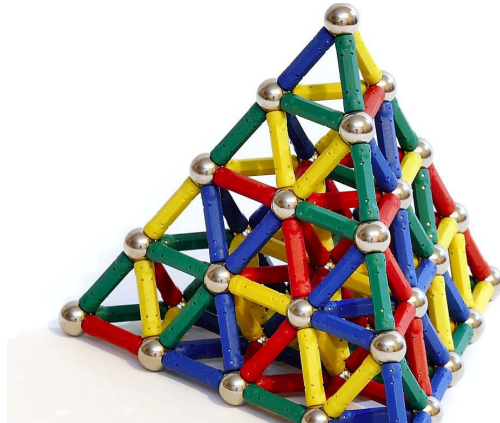


Fig 3.40



Fig 3.41

Construction toys

- I gave the **Lego construction toy** to Apurva, who was 3 years old and totally blind. He was using the toy for the first time and found **difficult to perceive** it. He needed help to identify how the pieces would interlock with each other. In this case, the pieces were joined together by male female joints.
- He got **frustrated** after he was unable to join the pieces in two-three attempts. He **refused to continue** after this.
- '**MagWeb**' is a **magnetic construction toy** in which the pieces have button magnets on ends and connected to each other using steel balls. Fig 3.40 shows a similar kind of construction toy. This time Apurva was able to join the pieces. Though he did not explore it much in terms of making the 3D forms for which they were intended, he found it **easy to join the pieces** and seemed to **enjoy the process** of joining them.
- For them, **joining and removing** objects was much **easier** when **assisted by magnets** instead of the male-female joints in conventional construction kits.

Figurative toys

- Among the figurative **toys**, toys having **texture, sound and motion generated more interest** amongst the children.
- They could not identify the object and it had to be explained to them. For e.g. a **dinosaur** was given to children. Some of them **identified** it as a **dog** as it had some of the characteristics e.g. 4 feet, tail, body etc. Moksha, who was 5 years old and was totally blind, knew about dinosaur as he had heard about it in the Jurassic Park movie but others weren't aware of it.
- Toys generating some **sound or motion** interested them and they kept it **close to the ear** to feel the same.
- Some of the toys were battery operated had **buttons for activating** the sound. **Buttons were easy to locate if they had a different shape, texture or colour compared to rest of the body.**
- They **stopped playing** with it after some time when they realized the toy couldn't be **explored further**.



- Animal toys with motion (e.g. spring wound) generated excitement both for the children as well as the teachers. The teachers felt that it was **easier to explain things** which otherwise is very difficult for a blind child to perceive. For e.g. exaggerated **abstraction** of mosquito helped the children understand its various parts e.g. body, legs, wings. The motion simulated by the toy was similar to the buzz generated by a real mosquito.



Fig 3.42



Fig 3.43



Fig 3.44



Fig 3.45



Fig 3.46

Objects

- I gave them different objects to each child which included the following:
 - **geometric shapes** like cube, prism, cylinder and sphere made of wood.
 - different types of **stones and marbles**.
- The **geometric shapes** did **not** create much **interest**. The wooden pieces had **no texture** on it. Moksha **identified** the **conical shape** as the **top of a temple**. He had been taught about the same using a **scaled model**.
- They got attracted to the **stones and marbles** due to the **tactile feel** and the **sound it generated by moving it together**. Fig 3.43 and 3.44 shows five year old Rukhsana transferring the stones from the floor into the container and vice-versa. Fig 3. 45 shows Apurva doing the same with marbles. **The stones and marbles gave them tactile sensation and transferring it from one container to other gave an auditory feedback**. Fig 3.46 shows Moksha moving his hands over the stones which gave him a tactile sensation.
- Moksha was curious to know where the stones came from. I told him they came from the sea and the fishermen caught it for children. He probed further and asked how fishermen and scuba-divers were different. When told scuba-divers go underwater he asked, 'Do the sharks eat scuba-diver?' to which I answered 'yes, they do eat them sometimes'. To which the child asked '**Do the scuba-divers eat the shark?**' Then I explained him that sharks are too big to be eaten by humans. From this I inferred that the concept of scale was not very clear to him.



3.2.6 Xavier's Resource Centre for the Visually Challenged (XRCVC)

So far I had interacted only with the younger children at the schools and centres. Through these interactions, I had formed a mental picture of a blind child, like their lifestyle, capabilities, aspirations etc. But I was curious to know about the **lives of visually impaired adults**. What were the **kind of aspirations** they had? What **problems** did they face in the society? How did **technology** help them overcome their disability? What kind of products would be more **meaningful** to their lives?

I got to know about XRCVC from **Mr. Vijay Shukla**, who taught at the NAB centre. XRCVC was a place where I could meet and interact with adults. He suggested me to meet Mr. Prashant Naik, who was one of the key people who managed the place.

This Centre was established with an objective of providing **equal opportunities for holistic growth** of the visually challenged by means of technology, training and support services.

Projects undertaken by the XRCVC:

Project X-sight

- Project X-Sight works towards equipping the visually challenged persons with the required **skill sets** and the **right attitudes** to meet the challenges of life.
- The goal is to see them as independent, self reliant and integrated people contributing equally to the world around them.

Project Access

- '**Accessibility**' to environments, services and resources is a key concern for the visually challenged persons in their day-to-day life.
- Project Access is a step towards challenging some of these limits and barriers that exist in the path of the visually challenged persons and thereby expand their access.
- Currently the project focuses on access to the printed word and the related copyright challenge and access to banking and financial services.

[15]

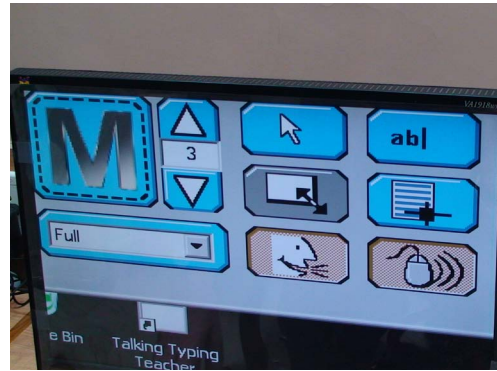


Fig 3.47



Fig 3.48

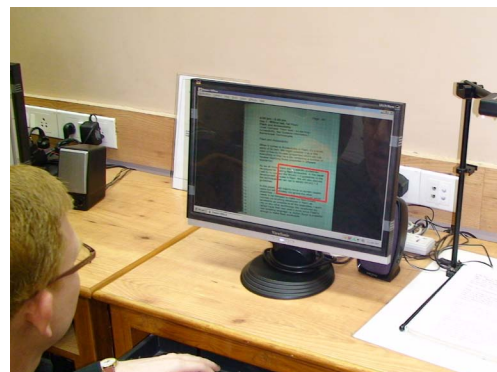


Fig 3.49

The centre is equipped with state of the art software and hardware, which facilitate ease of learning and studying for the visually challenged. The software and hardware support available at the centre include the following:

- **JAWS or Job Access With Speech** - a screen **reading software** that **reads aloud** all computer application, enabling students to access and use the computer.
- **MAGic** - a **screen magnifying tool** that enables persons with low vision to successfully access the computer as shown in Fig 3.47
- **Shree-Lipi Braille** - Indian language **Braille translation software**.
- **Kurzweil 1000 OCR** - a reading software to enable the user to scan printed material and have it read out and edited through the computer. This material can then be transcribed into Braille.
- **Talking Typing Teacher Software** – a specialized software to teach typing skills
- **Speaking Spelling** - a specialized spelling tutor.
- **Mountbatten MB Pro** - a talking electronic Braille that provides Braille output of diagrams like maps and graphs.
- **Index 4X4 PRO Braille Embosser** - a heavy duty Braille Embosser which can print Braille books from electronic sources.
- **SARA - (Scanning and Reading Appliance)** – this can scan any printed material and read it aloud. From the fig one can see that the the **interface** of this appliance is kept very **simple, with large, brightly coloured buttons** as shown in Fig 3.48.
- **Prisma** - a closed circuit camera device to help low vision users see printed and other materials on a television monitor in a magnified form.
- **Zoom Ex** – an instant **photo scanner** that allows for printed material to be **magnified and read out** almost instantaneously as shown in Fig 3.49.

[16]



- When asked about the kind of **careers** the blind people took up in their life, Prashant told that apart from **certain exceptions**, they could do **any job** like a normal person would, for e.g. **banking, IT etc.**
- He believed that with **proper training and support**, blindness would not become a barrier in the way of achieving his/her goals.

Fig 3.50 shows Ekinath using Gmail on his laptop using JAWS software.

- **Ekinath** was **congenitally blind** and was pursuing his **2nd year of management studies** at a reputed institute. He seemed to be very **confident** about himself. He didn't see his condition as a disability but saw it as a challenge and wanted to be recognized for his abilities, not disabilities.
- There were things he wanted to do, e.g. **play computer games** but couldn't do so as he was **not aware** of any game adapted for the blind.
- Asked about what he would create for the blind **given a chance**, he said that he would like to do something by which the blind could **learn advanced mathematics easily**. Apparently he had found it very difficult to understand higher level mathematics while studying in his school/college.

Fig 3.51 shows the emboss printed map of India.

- Prashant shared with me the **problems** that the blind people faced especially when appearing for competitive exams like **CAT**. They found it **difficult to understand mathematical symbols like beta, alpha** etc. and especially children from special schools found it more difficult to understand as most of the concepts were new to them when they joined normal school.
- The **solution** for such a problem would be to **emboss print** such symbols on the paper so that they could perceive them easily.
- '**Thermoform**' is a corporation which does embossed printing, but the **cost of this technology is very prohibitive**. Mass printing is not feasible with this technology. He told me that there was a need to find a **cheaper solution** for mass printing.



Fig 3.50

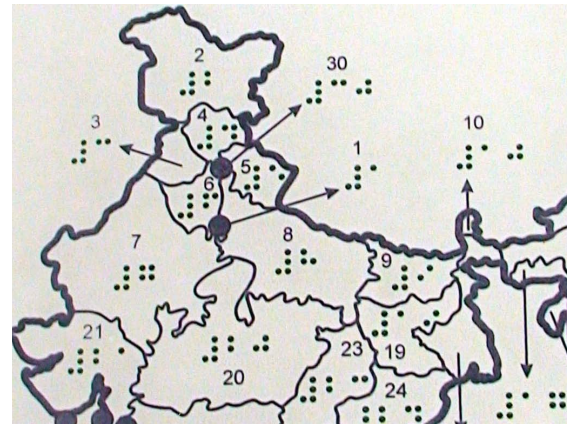


Fig 3.51



3.2.7 Stay at Pragati Andh Vidyalaya, Badlapur

I came to know about this school through Smt. Mrunal, the special teacher at NAB I had earlier interacted with. She told me that the principal of this school was very co-operative and interacting with the children at the school would be of help to my project. I contacted the principal Smt. Suhasini Manjrekar, and got permission to visit the school.

Pragati Andh Vidyalaya(PAV) is a co-ed residential blind school located in the Badlapur which is on the outskirts of Mumbai. This school was started by Smt. Suhasini Manjrekar in the year 1968 for visually impaired children who came from low socio- economic background. Currently the school has 85 students. **Five** of these children were **totally blind** and others had varying degree of visual impairment. Most of the children come from interior places in Maharashtra state so they visited home only once or twice an year.

Unlike other special schools that I had visited, this school was much more open to outside visitors. The principal suggested me to have a look around the school and meet the children. After meeting the children over here, I requested the principal to allow me stay in the school premises at a later date. I told her that this would bring more clarity in my project. She was very receptive to this idea and assured any kind of help I would need for my project. **I stayed at the school for three days between 3rd-7th Mar 2010.** This visit helped me form a **deeper relationship** with the **world of the visually impaired children.**

The school **didn't offer many facilities** compared to the schools I visited in the cities. For e.g. there were no activity room with toys, library, computers were not used as there weren't people to train, no televisions, lack of Perkins Braille etc. But the **children excelled in the limited means** they had, particularly in **craft and music**. The principal also claimed that some children were good at roller skating and had represented the school and won in various competitions, some of them which were international.



Fig 3.52



Fig 3.53



Fig 3.54



Fig 3.55



Fig 3.56



Fig 3.57

A normal day

Fig 3.52 show the boys dormitory.

- The day starts at 6:00 a.m. with the caretaker ringing alarm bell
- Each child had his own **personal space** i.e. a bed and a locker, and was able to **locate it by himself**.

Fig 3.53 shows the children assembled at the hall for breakfast.

- I noticed that the children formed **straight files** by distributing themselves into 4 groups. They were trained to do the same, but the place occupied by the children was different everytime.
- They would **feel the quantity being served by hand** and tell the person serving it if was enough.
- Totally blind children would use the **wall as reference** to move around the hall to avoid stepping into someone's plate by mistake.

Fig 3.54 shows Farhan playing drums in the break time.

- After breakfast the children had an hour before the school started. Some practised musical instruments they liked, talk with each other in groups or just dress up and get ready for the school. Farhan is 15 years old and has low vision

Fig 3.55 shows the **teacher help** them orient to form a straight file.

- The teachers used this as an example to teach them the **concept of a straight line**.

Fig 3.56 shows the teacher read out the **important news** to the children.

- This was their **window to the outside world**. The boys were particularly interested to know about cricket news.

Fig 3.57 shows the children reciting the morning **prayers**.

- The children proceeded to their respective **classes** after the prayer.



The medium of learning

Fig 3.58, 3.59 and 3.60 show the children using braille & stylus, reading Braille and using the Taylors frame respectively.

- The medium through which the children learnt was same as that at other schools.
- However here there was no differentiation between totally blind and low vision children i.e. the low vision children did not have access to large print books and all of them had to learn Braille and the Taylor's frame.
- The reason behind this was that the low vision children would eventually lose most of their residual vision as they grew up. Learning Braille and Taylor's frame would become more difficult at an older age.



Fig 3.58



Fig 3.59

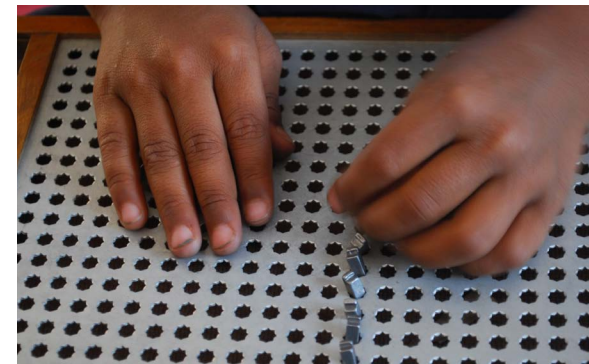


Fig 3.60



Fig 3.61



Fig 3.62



Fig 3.63

The classrooms

Fig 3.61 shows the teacher interacting with the children in the classroom.

- I observed that the smaller children (1st std. to Vth std.) sat on the floor and the **class didn't have any furniture** to avoid them getting hurt.
- In this class they were being taught what '**paper**' means and how the same object can have **different applications**. As a test, they were asked to tell about products which used paper as a material and they came up with **many answers** e.g. note, craft paper, envelope etc. The **teacher appreciated** every time the child gave a correct answer and this seemed to **boost** their **confidence**.
- The teacher also told me that they **enjoyed singing and listening to rhymes**. They **learnt** things **faster** when taught in this manner. Most of the children did not display the same enthusiasm for learning mathematics and braille as they did for craft, music or stories.

Fig 3.62 shows Amar learning Maths through the Taylor's frame.

- **Amar** is 5 years old and is **totally blind**. He had difficulty in learning Mathematics through Taylor's frame.
- He was not able to perceive the **alignment of the pegs** on the Taylor's frame and the teacher would repeatedly scold him for not being able to place the peg properly.
- This had **affected his confidence** and he was afraid of the subject as well as the teacher.
- He was able to count numbers verbally but his **perception of touch** was **not fully developed** because of which he was finding it difficult to use the Taylor's frame. He needed help to **develop** his **perception of touch**. He could also be taught maths through alternative medium of **Abacus**.

Fig 3.63 shows a teacher explaining Braille to the children.

- **Learning Braille** was **not easy** for the children. For smaller children the act of piercing the paper with stylus required a lot of effort.
- Most of the children were not interested particularly in learning Braille. One reason was that the **way it was taught in the school didn't interest them**. They would prefer to be in craft room most of the time.



The craft work

Though the children had varied interests, most of them showed more inclination towards the craft activities. Like the Dadar school, this school also exhibited works of their children with pride. Most of these works were done by children with low vision.

Fig 3.64 - 3.69 shows the different kinds of craft products that was displayed in the principals room. Again here, these works were mostly done by children with low vision.



Fig 3.64



Fig 3.65



Fig 3.66



Fig 3.67



Fig 3.68



Fig 3.69



Fig 3.70



Fig 3.71



Fig 3.72

The Craft Room

- As mentioned earlier, **craft** was an activity they were particularly **interested** in, as it gave them **opportunity to explore** and **create things** on their own.
- Children between the age of 5-8 were taught in the medium of clay and paper, while the older ones did weaving, tie and dye etc.

Fig 3.70 shows a the teacher explaining the child shape of a pot made in clay.

- The child is taught to work with the **clay** in steps of **kneading, rolling, pressing etc.** till he gets a similar form.

Fig 3.71 and 3.72 show the children doing 'origami'.

- **Origami** was **taught** to the children by making them **feel the folds** and **shape** of the paper at different stages. They **memorized this procedure** and were able to **reproduce** the same. There is no medium for teaching origami to visually impaired other than through hands. So they have to be **dependent on sighted people** to do the same.
- I taught them to make different objects using origami, and I found most of them were very enthusiastic about learning it and wouldn't rest until they memorized the procedure for making the same.



Fig 3.73



Fig 3.74



Fig 3.75



Fig 3.76



Fig 3.77

Music

I attended a session in which the children were practising for an upcoming orchestra. Most of the children here had specialized himself/herself in one musical instrument or the other. They had very good co-ordination between themselves and performed many songs, most of them which were devotional.

Fig 3.73-3.76 shows the children playing different musical instruments displaying their capability.

Fig 3.77 shows two children singing a devotional song and others listening with folded hands. Though they couldn't see and copy they had been trained to do the same.

This was a medium by which they could express themselves and in the process helped them develop physically (fine motor skills) and psychologically (cognition/emotional).



Dance

Some of the children also had interest in dance activities. After the orchestra, there was a session in which the children demonstrated their dancing skills. Teaching them to dance, especially co-ordinated group dance was difficult as they could not copy the steps visually. The principal told me that the dance teacher taught the children by a mix of verbal instructions and making them feel the positions by body to body contact at every step of the song.

Fig 3.78-3.80 shows the children doing different kinds of dance.

Dancing helped the children in following ways:

- It increased their spatial awareness as well as their feelings for speed and direction.
- This was also a team-building and confidence building activity.



Fig 3.78



Fig 3.79



Fig 3.80



Fig 3.81



Fig 3.82

Story telling session:

Fig 3.81 and 3.82 shows the children listening to stories.

- They liked to listen to **stories**. I arranged for a story telling session after dinner time in which children would share stories they knew with each other. The children were very excited and almost everyone turned up for the same. **Initially** they were **shy** and took time to open up.
- One of the girl Namrata, who had become visually impaired **adventitiously** took the initiative and told a story which she had read when she had vision. Another child Farhan, who was also adventitiously blind told a story which he had heard before coming to this school
- The children were **rapt with attention** when the stories were being told. The session continued till it was time for the children to sleep.



Recreation

Fig 3.83 shows a boy using his fingers to feel the pieces on the chess board

- The **only board game** the children over here had access to, was **chess**. The chess board was modified for the visually impaired. The pieces had pegs which would sit on the holes in the board. The pieces were differentiated by **tactile projection** on the white ones.
- **Older children** were very **interested** in playing **chess**. They managed to make a **mental map** of the game by feeling the pieces which were pegged on the chess board.



Fig 3.83

Fig 3.84 shows the children playing 'dabbi dabbi' in corridor.

- The children did **not** have many **avenues for recreation**. They liked to play cricket but after breaking two window panes, the principal did not allow them to play in the lawn. She thought the **broken glass** was **dangerous** as the children walked **barefoot** in the premises.
- They developed an alternative **game** called '**dabbi dabbi**'. This was similar to football. The rule of the game was that one person of a team **kicks** a **plastic bottle** and other team has to stop it. If it goes 'over' and crosses the other team its counted as 6 and 4 if it goes from 'below'. Through inquiry I came to know not many of them knew about football.



Fig 3.84

Fig 3.85 shows a boy playing with 'Magweb'

The children who had low vision liked to play with 'MagWeb', the magnetic construction toy. Following factors attracted them to the toy:

- **Bright colours**
- **Easy joining** of pieces by **magnets**

Some of the problems with this toy were:

- They had to keep the pieces **very close to their eyes** to locate them.
- The steel balls would roll off and **finding** them would **become difficult**. Same was true with the pieces, which were **small** in size.

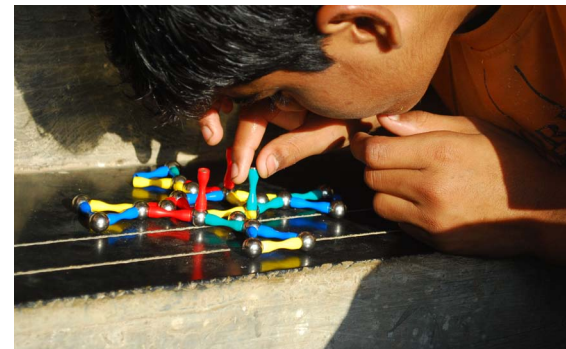


Fig 3.85



Interaction with teachers

Sandeep Kavde

Mr. Sandeep Kavde **taught Mathematics and Marathi** language at the school. He was **congenitally blind**. After completing his Bachelors degree in Arts he did his Diploma in **Special Education** from the **NAB**.

He shared his experience about blindness and how it made difference to his life. He had aspired to be a teacher throughout his life and eventually entered into the teaching profession. As a contract teacher at the school, he was paid Rs. 3000/- per month. Though satisfied with his work the **renumeration** was too **meagre** to sustain himself. Due to this reason, he was looking for other **job opportunities**. Finding appropriate job agencies was a **challenging** task. Most of the agencies would send their response through **SMS**. He had to **depend on others** to read the messages. There were very **few employers/ organizations** that gave **preference** to visually impaired people which made it more difficult for him to get a job. His **elder brother** had **supported** him so far but he was **worried** about his future.

Some of the other problems that he faced in his daily life were:

- Not knowing the bus no. while waiting in the bus stop.
- Difficulty in understanding the direction of motion in local trains.
- Difficulty in executing financial transactions at the bank.

He explained me the importance of '**Orientation and Mobility**' for blind children. He had got to know about this term while doing his course at NAB. **Ideally** there should be a **orientation and mobility instructor** in **every school** but this was not the case with most of the schools over here. In **our country** mobility instructor came into picture only when the individual started to learn **using a cane**.

An average age for using cane in our country is around 17-18 yrs. A cane serves the purpose of collecting information about the surroundings in absence of vision. **Ideally one should start using cane as early as possible**. But this was again not the case in our country. He added that cane was not used by children due to the following reasons:

- stigma associated with use of cane.
- familiarity of children with their surroundings in case of special schools.





CHAPTER 4 **Products for the Visually Impaired**

As the visually impaired people formed only a **small section of the society**, the **products** that were **designed specifically** for them was **limited**. There were **products available** for blind people in the **western countries**, but the **cost** of such products made it **prohibitive** for personal use.

Most of the products that people used over here were those that **satisfied** the **most basic requirements** and were **cheaply available**. From research I realized that in order to sell in this market, it was essential that the product should have **distinct benefits** of using it, and at the same time be **cost effective**.

Because of the challenging nature of the projects and the scope of innovation it offered, **designers liked to work in this area**. I came across **many innovative products** that existed at the **concept level**.

In the subsequent sections I have **elaborated** about some of the products that I found interesting in terms of its **simplicity and learning value**.



4.1 Tikk-Tekk Rainbow

Guopeng Liang and Yun Li design, students from the University in China have built **Tikk-Tekk Rainbow**, a novel and low-cost universal measuring device that uses **visual, auditory and tactile feedback** for measuring an object and is particularly **designed for visually impaired individuals**. It features two **rubber plastic rings** that you slip over each **finger** and has a string that unwinds when you're trying to measure something. The device makes a **"tikk" sound** every **1cm** and a **"tekk" sound** every **5cm**, while the digital display and the **embossed Braille numbers** also provide measurement results. [17]

Fig 4.1(a) shows the product explaining its various features and **Fig 4.1(b)** gives a schematic explanation of how the product is supposed to be used.

Though this product is at a **concept level** the design is very **unique** because of its **simplicity** i.e. making use of the metaphor of measuring by fingers. The product provides **multi-sensory experience** to the visually impaired person which makes the whole act more **enjoyable**.



Fig 4.1(a)

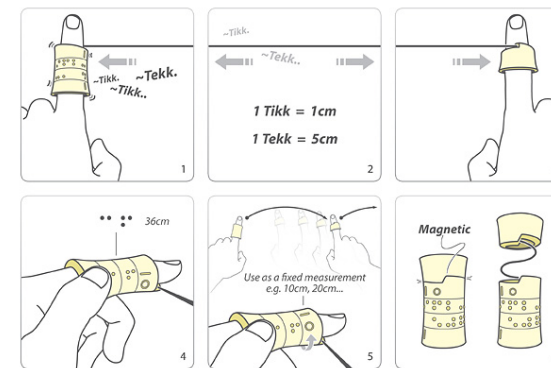


Fig 4.1(b)



Fig 4.2

4.2 Pop-A-Cell

This product is manufactured by the American Printing House (APH). A large-scale braille cell is presented on a card measuring 2 5/8 x 4 1/4 inches. **Pop the durable plastic cell dots up or down to create various braille characters.** It comes in a set of four - red, green, yellow, and blue - with a Braille Alphabet and Numbers Card. [18]

This product offers a **simple and fun way to teach braille** to any individual. **Being brightly colored** it is convenient for a person with **low vision** to use it.



Fig 4.3

4.3 Mayster Braille Loom

Jennifer Mayster conceived the idea for a special kind of loom that would allow her students who were blind or had low vision to **learn braille and weaving** at the same time. Using the **Perkins Brailier as a model**, she invented the Mayster Braille Loom. The loom has seven shafts and seven front levers, which **correspond to the levers on the Perkins Brailier**.

The loom is strung with yarn of different colors and textures. Each color and texture corresponds to one of the six braille dots. The weaver simultaneously pushes a combination of these levers, which lift different sets of strings and create textile patterns that are actually words. **Blind persons can read these words by touch, and sighted persons may decipher the words by the color combination.** [19]



Fig 4.4

Fig 4.3 and 4.4 show the product in use.

This is a unique example which has **elements of craft, education and recreation combined into one single product**. The motivation for using this product is that it gives an individual opportunity to learn **Braille in a playful** manner unlike the traditional method.



4.4 Vasantha Braille Cube

Fig 4.5 shows the **Braille cube**. This product is designed by Vidya-Vruksha, a voluntary service organization for the blind community in collaboration with IIT Madras. This is how the product works:

- This device has different patterns of raised dots on its sides, corresponding to the Braille representation of letters of any language.
- The raised dots appear in one or more of six positions arranged in two columns of three rows on each side of the cube.
- The cube consists of three segments that can be rotated about a common axis, so that different dot patterns corresponding to different letters can be formed on its sides.
- Each letter of the alphabet of any Indian language (any world language) can thus be represented on any one side of the cube.

The **function** of this product is **similar to the Pop-A-Cell** but is **more interesting** because it offers **more surfaces to play with** and is much **cheaper**. [20]

4.5 Natesh Braille Block

This product is also designed by the same organization. Fig 4.6 shows the product in use. Once the letters of the alphabet have been learnt, the child must be enabled to form words. The Natesh Braille Block is a device which enables this in a similar easy way.

- Here, the basic component unit is comprised of a thin octagonal disk, and a number of such units are held together face to face, on a common horizontal spindle.
- Each of the eight edges of each disk has raised dots in one or more of three positions, in any of the eight patterns.
- Two adjacent disks could be rotated on the common spindle, to generate any braille code on any pair of correctly aligned adjacent edges.
- With every two disks making a letter, adjacent pairs on a common spindle can be manipulated to make letters to form words.

Here again the **act of generating words by rotation of the disks is playful and motivates** an individual to form different Braille words. [20]



Fig 4.5

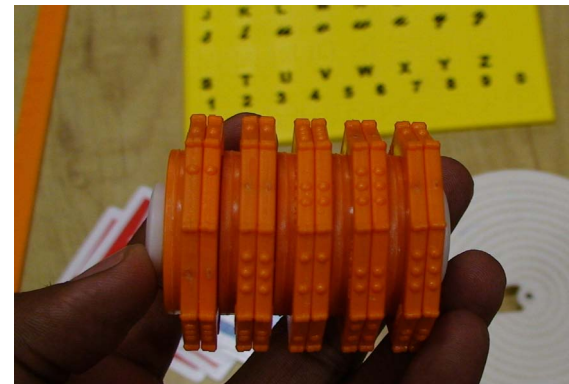


Fig4.6



CHAPTER 5 **Design Strategy**

After the research my **objective** boiled down to finding answers to the following questions:

- Whom to design for?
- What to design?
- How to design?

5.1 Deciding the age group

Ideally, early intervention (right from infancy) is required for a child with visual impairment so that he/she can learn to cope up by making effective use of the remaining senses and mitigate the delay in development. But from my observations I realized that this doesn't usually happen and in most cases, be it totally blind or a low vision child, the **development is delayed** by the time he is **admitted to the school**. The **average age** of a child while being admitted in schools was **five-six** years. Many teachers attributed the following reasons for the delay in development of the child

- Over-protective attitude of the parents which prevented the child from moving about and exploring the world around him.
- Lack of awareness amongst parents about early intervention programs run by organizations like NAB.

In such cases, it became necessary to provide ample **opportunities** for the child to become **self-reliant** and **independent**. Looking at the **existing systems** gave me lot of **scope to design** for this particular age group. Due to this reason I decided to **focus my design for children** in the age group of **5-8 yrs.**



5.2 Possible areas of design intervention

Understanding the needs of children, I narrowed down on the following areas on a broad level for my design. These areas were **not completely independent** and were **inter-related** in many ways:

- Vocation(craft)
- Education
- Recreation

5.2.1 Vocation (craft)

From observations it came across that the children had a **natural inclination** towards **craft**. It gave them an opportunity to use their **imagination** and **creativity**. In this area there could be scope for designing

- products that teach a particular concept easily through craft.
- tool kits that could help them create new category of products unique to the visually impaired.

This could have the following **benefit** for them:

- develop their interest in a new area/teach new concept through craft.
- provide a source of recreation
- develop their creative and mental abilities.
- create a source of livelihood at later stage in life.

Following were the **questions** I had in mind:

- What kind of material should I decide for focus on, e.g. paper, ceramic, fabric etc. or a completely new one?
- How would it be more beneficial than designing in other areas e.g. education, recreation etc.?
- Will the duration be sufficient to complete the project?
- What will be the scope for Industrial Design?

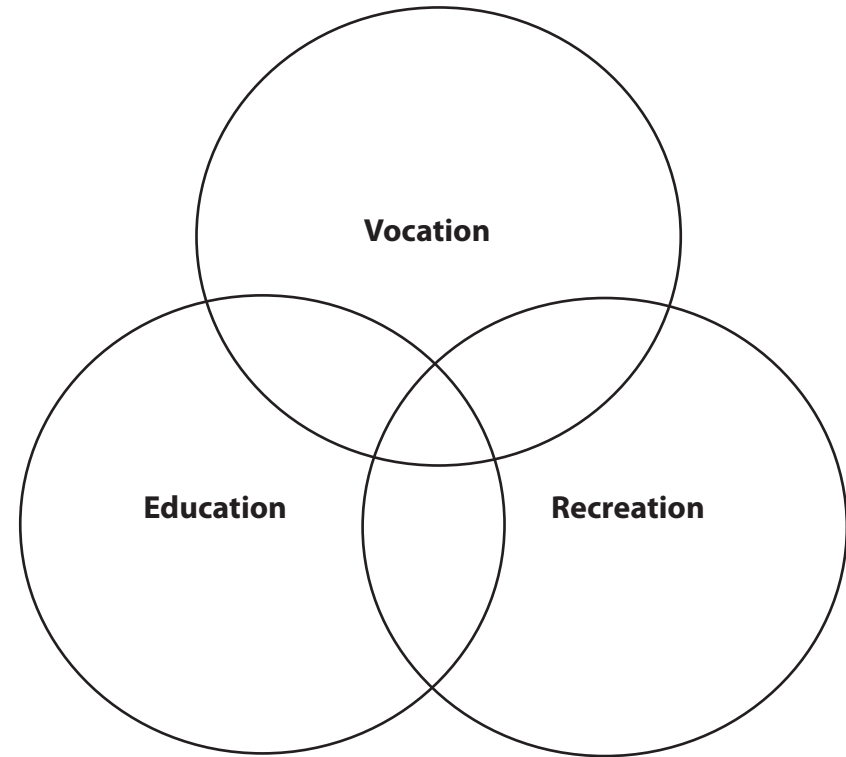


Fig 5.1



5.2.2 Education

This was an area in which the children had **problems understanding and learning** concepts. There could be scope for designing a

- learning kit that the special teachers can carry to the child's home. This would help in standardizing the kit and reduce the time required for the teacher to prepare the material.
- product that could make it easier and interesting to learn abstract concepts that are otherwise difficult to understand. e.g. atom structure, internal organs etc.
- kit to teach Braille and Mathematics through play. This would address the monotony that children faced while learning the same.
- product that help them to execute a task that they currently find difficult to do e.g. understanding orientation of pegs on the Taylor's frame.

Challenges:

- Deciding what would be relevant for the children.
- Considering the complexity of this area deeper study would be required.

5.2.3 Recreation:

Currently there are very **few recreational options** available for the visually impaired. A design in this area could offer the following scope:

- Games to help them improve their social/interaction/mental skills and confidence level.
- Playing kits that give them the avenue to learn through active play and exploration of objects aiding various, domains of development in the process.
- Toys/objects that allow children to do role-play

Challenges:

- To understand their different abilities and design accordingly to avoid frustration while using the product
- Understanding different kinds of textures, forms, sounds that would generate interest in the children by providing a multi-sensory experience.
- Learning value associated with the game/toy/kit. and domains of development it affected.



5.3 Deciding area of focus

Though **technology** seemed to be the **answer** to many problems faced by **visually impaired adults** e.g. talking software, etc. children had needs that couldn't be addressed by technology alone. For them **play** is an **integral part** of their **growth** and **development** as well as **learning** process. Considering that **play** is an important aspect of **recreation**, and the fact that this area has **not** been much **explored much**, I decided to choose it as my **focus area**.

Importance of play:

Young children's growth and development has a pattern and sequence which is related to age. **Children progress** in several areas such as in **physical growth, capacity for language, comprehension or in skills of interaction**. Children need to **move around** in order to **master body control**; they need to **explore, manipulate objects** and **repeat actions** to exercise their **mental, social and manual skills**, with enough opportunities to handle materials, experience the world around them, and perform **tasks of increasing complexity**. Children get **nourishment** for their **growth** needs through **play**.

Modern thinking on education affirms that the goal of teaching-learning process is to teach children "**how to learn**", i.e. to **explore, discover** and **practise thinking skills**, and **process information** so as to understand the world around. This **cannot** be "**taught**" and has to be **learnt**. [21]

Fig 5.2 shows the various **options** I had in front of me. Within the recreation area I had the options of designing either a **game, playing kit or a toy**.

- Considering the age group and requirements of the children, I decided against designing games as the winner-loser model could affect the confidence level of the child.
- Toys would serve the purpose of fun/amusement. Learning would be incidental.
- The need was to make a product that would give the children a sense of accomplishment, independence, and self-confidence that could transfer to real world situations through active play and exploration of objects.

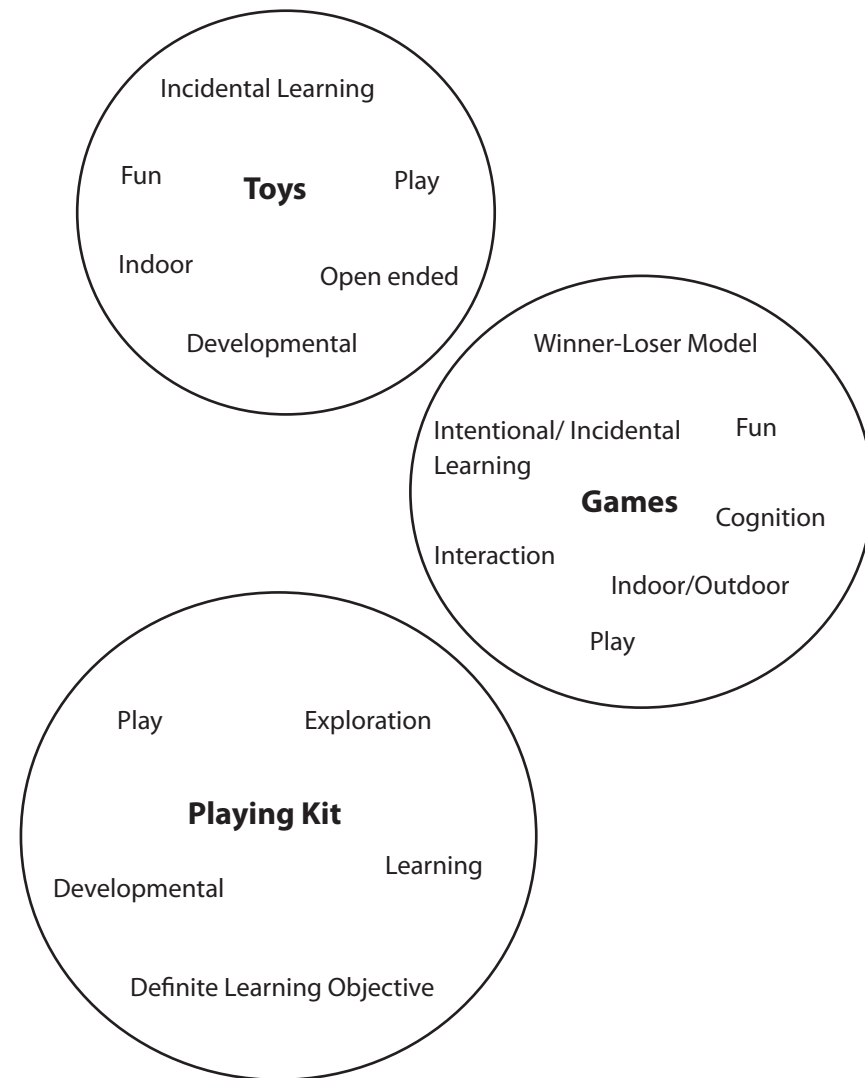


Fig 5.2

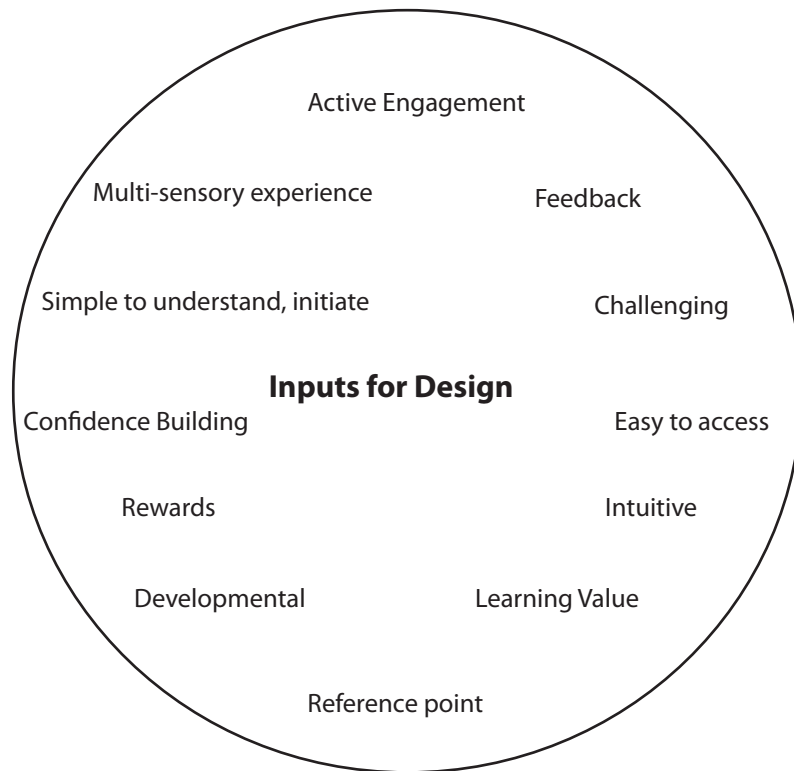


Fig 5.3

I felt that a **playing kit** with a **definite learning objective** incorporated in it would **address** many of these **needs**. Hence I decided to design a **playing kit for the children**.

5.4 Inputs for design from research:

Certain important **guidelines** emerged out of the research with regards to the kit, either **implicitly or explicitly**. They have been derived by **observing the children** and taking **inputs** from **individuals** associated with the **blind community**. Fig 5.3 shows the various factors that serves as a **broad outline** for the design:

The Playing kit should

- be a multi-sensory experience for the children
- make the child feel confident to carry out the task.
- use bright and contrasting colour for children with low vision.
- be intuitive, simple to understand, easy to initiate but at the same time be challenging.
- be easy for the children to access the kit on their own
- have feedback at each point to understand whatever they are doing is correct or not.
- have inbuilt rewards for completing a task correctly.
- active engage the child at every point of play.
- have learning value and a definite objective.
- affect overall growth and development but following domains should be given more importance:
 - Orientation and Mobility
 - Cognition
 - Fine Motor Skills
 - Interaction (child to child/child to teacher/child with kit)



5.5 Context of use:

Who will use it?:

Children in age group of **5-8 yrs** who are **congenitally blind** or have **partial/ low vision** will be the primary users. However **sighted children** will also be able to use it.

Where?

Indoor use at **NAB centres/ Special Schools**. I observed that there was at least one playing room or hall in the schools/ centres which could be utilized for playing activities.

How many children will use it?

2-3 children would use the kit at a time. Many teachers felt that 2-3 children would be ideal no. for a group activity.

How will it be used?

Initially teacher will explain how to use the kit, **later** they will be able to **play** by themselves.

Who will buy the kit?

NAB, Special Schools and **people** who might **donate playing kits** to such organisations.



CHAPTER 6 Ideation

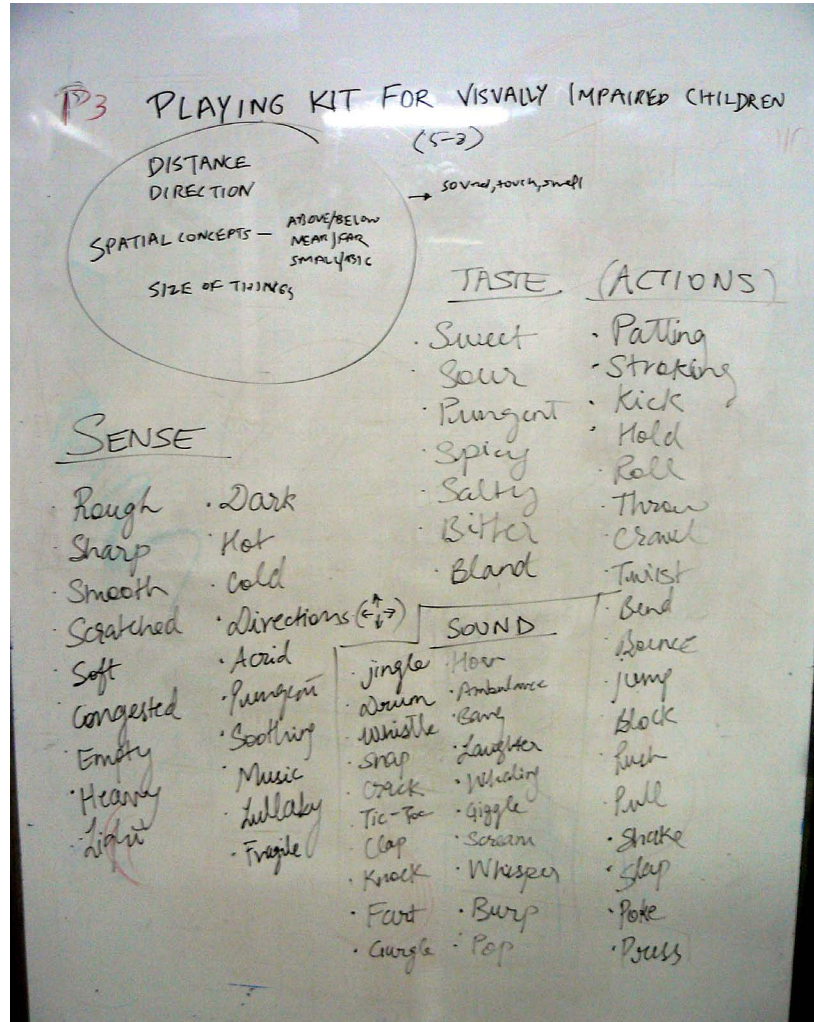


Fig 6.1

Brainstorming:

Before starting with the ideation process, I conducted a brainstorming session for generating diverse ideas for my design.

Duration of session: 30 min

Names of participants: Suhrid, Vinish, Prerak, Lakshmi, Harikrishnan, John, Ranjit, Yatin, Sandesh and Devina.

I explained my project to the participants after which we decided on four broad parameters for brainstorming:

- Sensory: e.g. Different kinds of touch, sounds, smell experienced by the senses
- Materials & Textures: e.g. rubber, leather, wood, velvet etc.
- Physical Actions: e.g. Jumping, pulling, climbing etc.
- Theme: e.g. Treasure hunt, role play, shopping etc.

The next step was to connect these independent terms and create diverse ideations. My initial ideations were directed towards improving the orientation and mobility skills of the children by engaging them with different objects in space.



Ideation 1: Treasure Hunt

Fig 6.2 shows how treasure hunt will be played.

- This will be a group activity in which the children will have to navigate the space and find the treasure by performing different tasks. The treasure will be kept somewhere inside the room.
- The children will be given a board similar to Taylor's frame which consists of array of holes. This frame will act as a map for the children to navigate the room. The teacher/instructor puts the pegs in a manner that is symbolic of the points in the room where the children will have to go and perform the tasks and find the treasure in the end.
- The tasks will be related in such way completion of one task will give clue to the other.
- They will start from a point and walk towards the next point by feeling the peg on the map. Here they will have to perform a task that will give them clue to the next point. for e.g. solve a jigsaw puzzle in Braille which when joined correctly will give the clue to the next task.

This activity will have following benefits for the children:

- Understanding positional/relational spatial concepts by relating the map (pegs on the frame) with the actual objects in space.
- Interacting between themselves and with the objects in space.
- Tasks like solving jigsaw puzzle will improve their cognition, tactile perception and ability to discriminate between shapes.
- There can also be tasks which improve their kinesthetic sense. For e.g. climb up and down a ramp/ladder and fetch something.

Problem areas:

- Setup time required will be more
- Safety issues due to the objects in the space
- Loss of reference point while playing
- Explaining the instructions to children
- Difficulty in finding pegs if they get lost

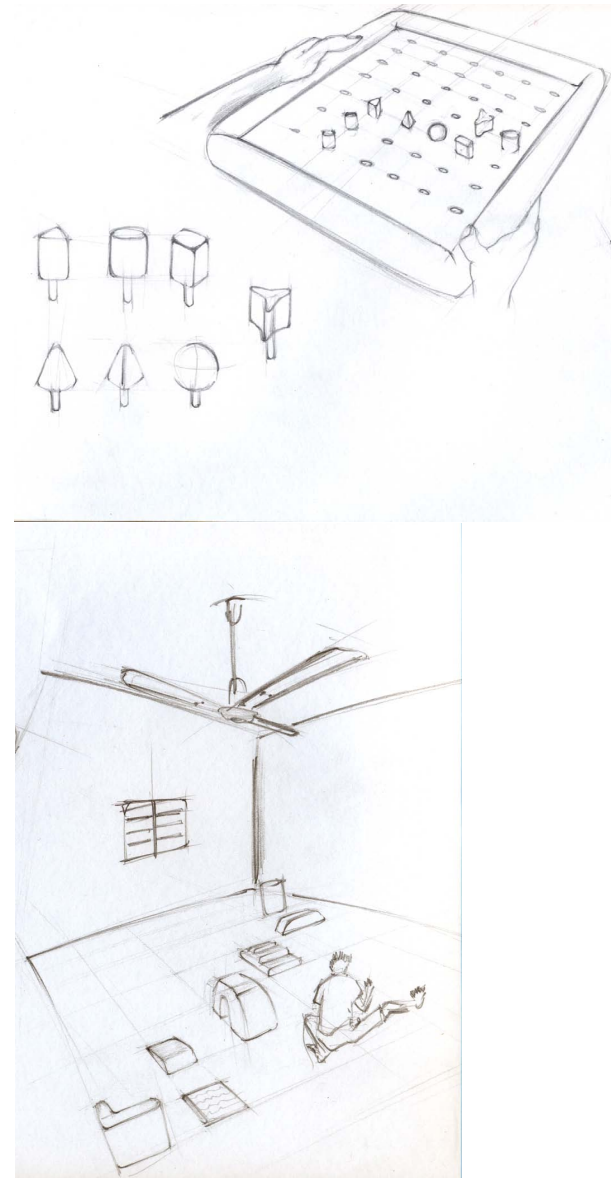


Fig 6.2



Ideation 2 Match Match

- This is an activity in which the children will be required to complete box of a particular shape by interacting with each other.
- The kit will consist of boxes of different shapes, sizes and textures that are split and separated into pieces, similar to a jigsaw puzzle. The pieces will be divided amongst the children.
- The children will be placed at different positions in the room and each child will have multiple pieces in a pouch/bag. The children have to find the matching piece for a box they want to make by interacting with other children. Once they find the pieces they'll have to join them correctly to form a box.
- The correct combination of the box will play a music which will give the children feedback what they have made is right or not.

This activity will benefit the children in following ways:

- Improve interaction between themselves and with the objects.
- Improve their tactile perception and perception of shape
- Improve their cognitive and fine motor skills by joining the pieces together correctly.
- Provide them with a multi-sensory experience through tactile as well as auditory feedback.
- Improve their spatial awareness by moving about the indoor space.

Problem areas:

- **Safety issues** due to moving around in space.
- Loss of reference point while playing
- Explaining the instructions to children

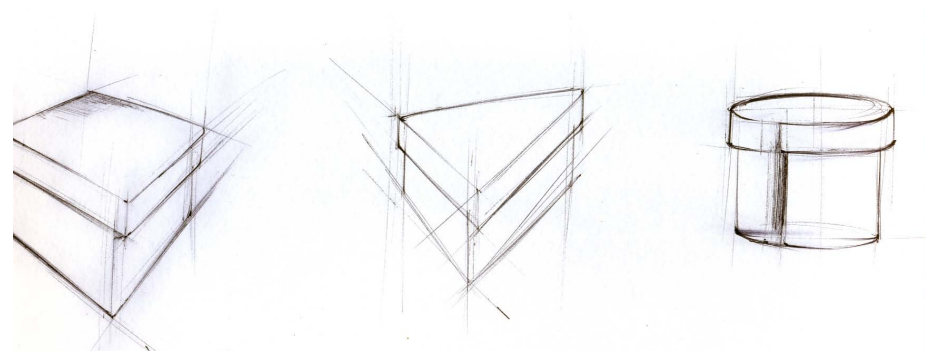


Fig 6.3



Ideation 3 Role Play

The objective of this activity is to provide an environment where the children can do roleplay. Fig 6.4 explains the ideation.

- The kit will have objects that will be interspaced in the room that simulate the real world. e.g. footpath, divider etc. The children will have to navigate through that space with a cane and perform different tasks. The objects will change according to the theme of role play. For e.g. one day it will be city, the other day it can be jungle.
- For e.g. a scenario can be build that in a city the child is required to travel to his friends house. Starting from a point there will be various objects/people that he/she will have to interact with. e.g. go to a shop where he has to buy certain gift for his friend. He will buy the gift from the shop and pay the shopkeeper (who will be another child). Then he will have to cross the road and go to the bus stop. Here he will climb the bus by identifying the correct bus no. and pay money to the conductor to buy a ticket. He will get down at his friend's place, meet him and come back to the start point.
- A modular kit can be thought for making the same which can be assembled and dissembled fast.

This activity will benefit the children in the following way:

- Build confidence by simulating the outside world experiences in an indoor environment
- Teach them the concept of using landmarks
- Improve their social, cognitive and physical skills
- Orienting body in the direction of sound

Problem areas:

- Set up time required will be very high
- Safety issues due to objects in space.

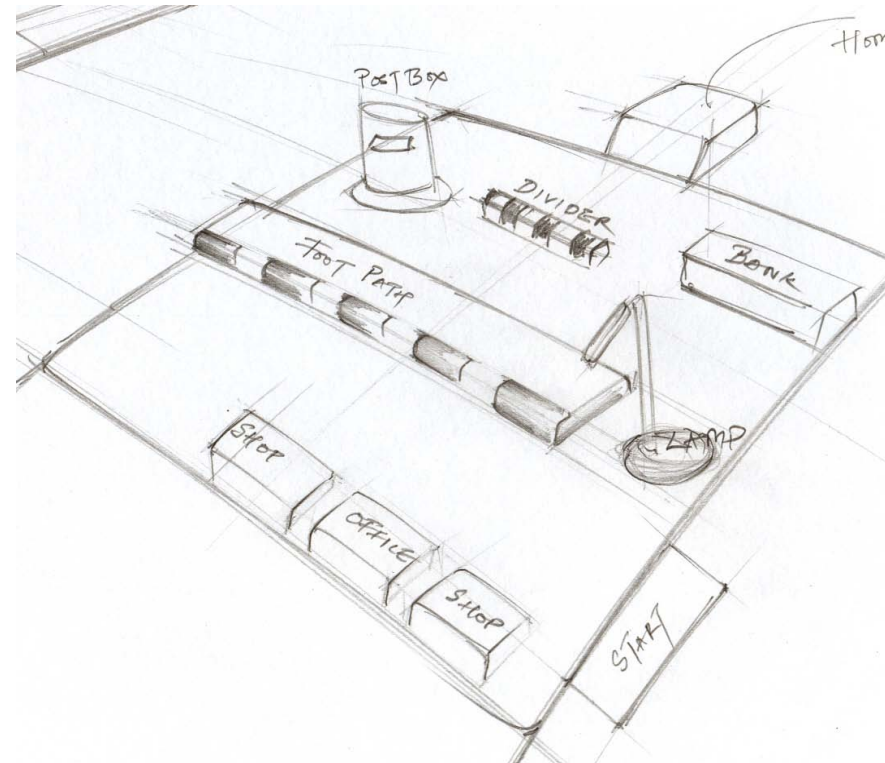


Fig 6.4

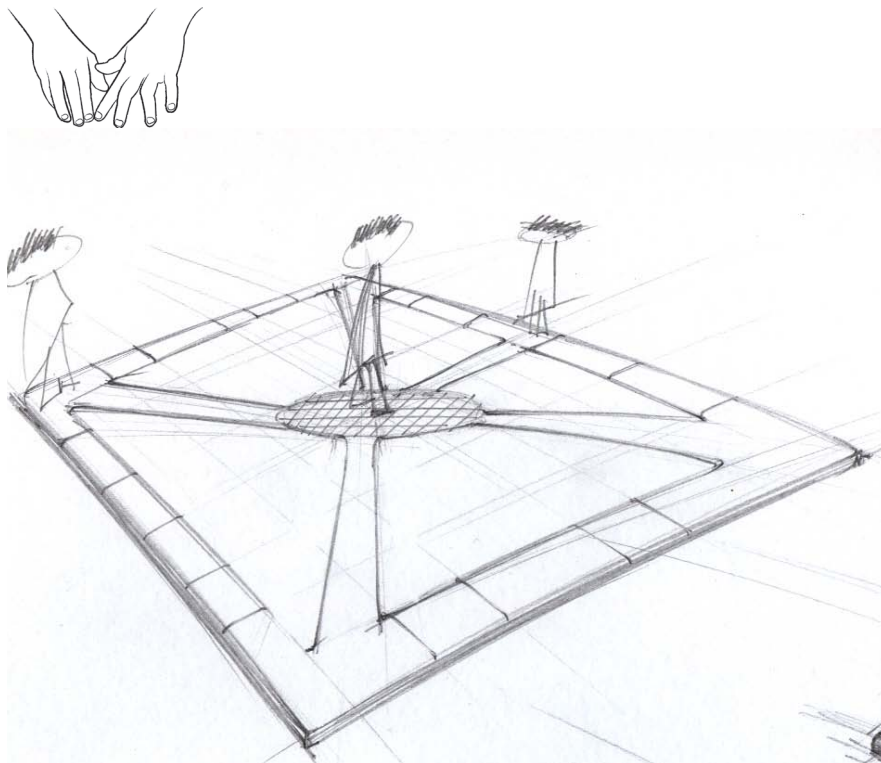


Fig 6.5

Ideation 4 Magic Mats

Fig 6.5 shows how the game is played. This kit will consist of textured mats that are modular and can be arranged in space to generate different configurations. One of the games that can be played is explained as follows:

- The mats will be connected to each other and arranged inside the room as shown.
- The central mat will be connected diagonally to the mats arranged in square shape.
- One child will stand in the centre and others will be in the corners or along the sides of the square.
- The children on the sides/corner will make noises which the child at the centre has to identify and move in that particular direction along the mat.
- He has to bring all the children at sides/corner to the centre.

This will be of following **benefit** to the children:

- Improve their orientation skills by making their body orient in the direction of the sound.
- Understand the concept of straight line while walking on the mat.
- Improve cognition, physical and social skills.
- By counting the no. of children who are around him, he learns to count.
- Improvement of spatial awareness by moving in space.

Problems:

- Explaining the rules to children will be difficult
- Lack of play factor
- Time required to set up is high



- Another game could be one in which the mats are arranged in **matrix of 7 x 7**. One **child stands in the centre** and **four others** stand around him on the sides.
- The **child at the centre** will be given **braille cards** on which questions on different subjects will be printed asks questions to the children around him. The child at the centre **moves one step towards the child** who **answers** the question **correctly**.
- For e.g.The child asks a question such as ‘Who is the Prime Minister of India?’ and the child in front of him answers correctly then the child at centre moves one step towards him.
- **The questions continue** till the child at centre **crosses over completely** to one of the children at the sides and this child will be the **winner**.



CHAPTER 7 **Testing**



Fig 7.1



Fig 7.2

7.1 PAV, Badlapur

To **validate** whether the direction I was taking was right or not, I decided to **test** one of the ideas. I wanted to understand how the **children** would react to a **game with rules**. I tested it for children in the age group **5-8 yrs** and **8-12 yrs**.

For testing this game, I made tiles of size 1 sq. ft out of corrugated sheets and foam boards. These tiles were stuck to the ground using double sided tape and arranged in 7 x 7 grid.

The testing was conducted at Pragati Andh Vidyalaya. As shown in the Fig 7.1 one person stands in the centre and four others around him. The person at the centre calls out questions and he moves one step towards the person who answers the question correctly, either in front, back, left or right.

The **game was a failure** due to following reasons:

- **Small children could not understand the rules.** They were playing the game just because they were told to and didn't seem to enjoy.
- They **could not get positional feedback** of other children near/around them. Some children reached out their hand in space to check if the person was near him.
- **No fair chance** for everybody. There was confusion about who answered the question first. This caused **frustration** especially amongst older children.
- High **dependence on the voice of the person** asking questions. Person standing behind was not able to hear clearly.
- They could **not associate with the winning criteria**. They had to be **told** that the game was over.
- The children **didn't have problem understanding concepts** like **front, back, right and left** which negated my assumption that they need to be taught about the same through play.
- It was a very **static game** and did **not keep** the children **actively engaged**.



Fig 7.3



Fig 7.4



Fig 7.5



Fig 7.6



Fig 7.7



Fig 7.8



Fig 7.9



Fig 7.10

However, there were other interesting observations that came out of the testing. Before the tiles were stuck to the floor, the children did not know what they were meant for. They explored the tiles to do different things.

One of the child Santosh had low vision. Fig 7.3 shows him arranging the tiles in a grid format with the coloured side faced up.

Then the other children came into the hall and tried using the tiles as building blocks to construct different structures.

The children who made these structures had low vision and they found it easy to handle the tiles mainly due to its large size. They did not have to hold the pieces close to their eyes.

Fig 7.4 and 7.5 shows the children trying to balance the tiles to make a stable structure out of it.

Fig 7.6 - 7.8 shows the children trying to build different structures out of the tiles by using wall as the reference. These children realized that it is easier to make a structure by resting one of the tiles on the wall.

Fig 7.10 shows the children enjoying the Once the tiles were fixed to the ground, the smaller children got very excited about it. This was a new experience for them. They started jumping, rolling, dancing over the tiles. The jumping action on the tiles gave auditory and tactile feedback to them which made them do it again and again.

My learning from this session was that games won't work with the children as the rules and instructions were too abstract for them.



Fig 7.11



Fig 7.12



Fig 7.13



Fig 7.14



Fig 7.15



Fig 7.16

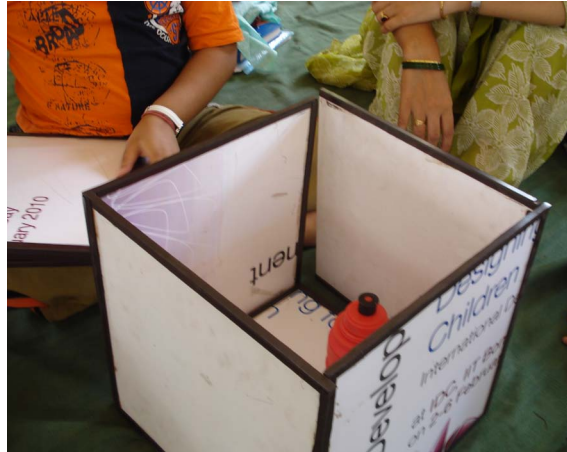


Fig 7.17



Fig 7.18

7.2 NAB centre, Thane

For testing my next idea, I used flat panels of 1 sq. ft. made of foam board. The panels could be joined to each other by flexible magnetic sheets that were pasted on the edge of the panels.

I took eight such panels to the NAB centre at Thane. My plan was to test this product with children who were totally blind as well as those with low vision. Being holiday season, there was only one child present at the centre.

Kavya was eight years old and had low vision. She was accompanied by her mother Smt. Rekha and teacher Mr. Vijay Shukla at the centre. I explained them how the panels can be joined with each other to create structures and gave it to them.

Fig 7.11- 7.18 shows her using the kit in different ways.

- Initially she was **not aware** of what can be done with the kit. Her **mother explained** to her how the kit can be used.
- Slowly she started taking **interest** and tried to **join the pieces herself**. She **realized** that it is very **easy to join** the pieces and started **exploring possibilities**. She **discovered** that the kit can be **used** to make a **variety of structures**.
- She made an **open box first**, then she added two panels on top to form a **house**. She then dismantled the whole structure and made a **box again**, this time to **store her bottle**. She placed a panel as lid on top of the box.
- While she is using this kit, her **mother and teacher constantly** kept on **appreciating and encouraging her**. Every time she **made something new** she got **delighted** and told them about the structure she had made.



Fig 7.19 and 7.20 shows how she tried to use her residual vision to read what was written on the panel.

Fig 7.21 shows the chair she made out of the kit.

Fig 7.22 shows how she used the magnet as a hinge and the panel as a door/window.



Fig 7.19



Fig 7.20



Fig 7.21



Fig 7.22



Fig 7.23



Fig 7.24



Fig 7.25



Fig 7.26

Fig 7.23 - 7.26 shows how she thought of a two storied structure and made the same out of the kit. After making the structure she got inside it which delighted her.

Her mother liked the kit and she told that she had not played previously with such kind of kit. but felt that the individual panels were big in size and should be reduced. I explained that low vision children found it convenient to handle objects of larger sizes. Also there should be more variety in the shapes of pieces, which the children can use to make more kinds of structure.

Her teacher felt that the kit was very useful for the children. It could be used to improve the child's imagination, bring about movement of various body parts and improve the orientation and mobility skills of the children. He also told that she could learn to use this kit faster as she had low vision, but it might take more time for a totally blind child to understand how to do the same.



My next idea was to give her a set of flat panels made of foam board on which I pasted strips of textured corrugated paper in different kinds of patterns. To generate high contrast, black paper was used with a white background. There was no intended play with the kit this time, but she made her own interpretation and started using it.

Fig 7.27 shows Kavya feeling the texture and following the pattern with her fingers on one of the panels.



Fig 7.27



Fig 7.28



Fig 7.29



Fig 7.30



Fig 7.31

Fig 7.28 - 7.31 shows her connecting the panel with each other by matching the the ends of the textured strips to form a continous pattern.

Initially she tried to join the textured strips in such a way that there is no gap between the panels. After realizing some of the panels won't fit in that way she connected the panels randomly by matching the textured strips at the ends.

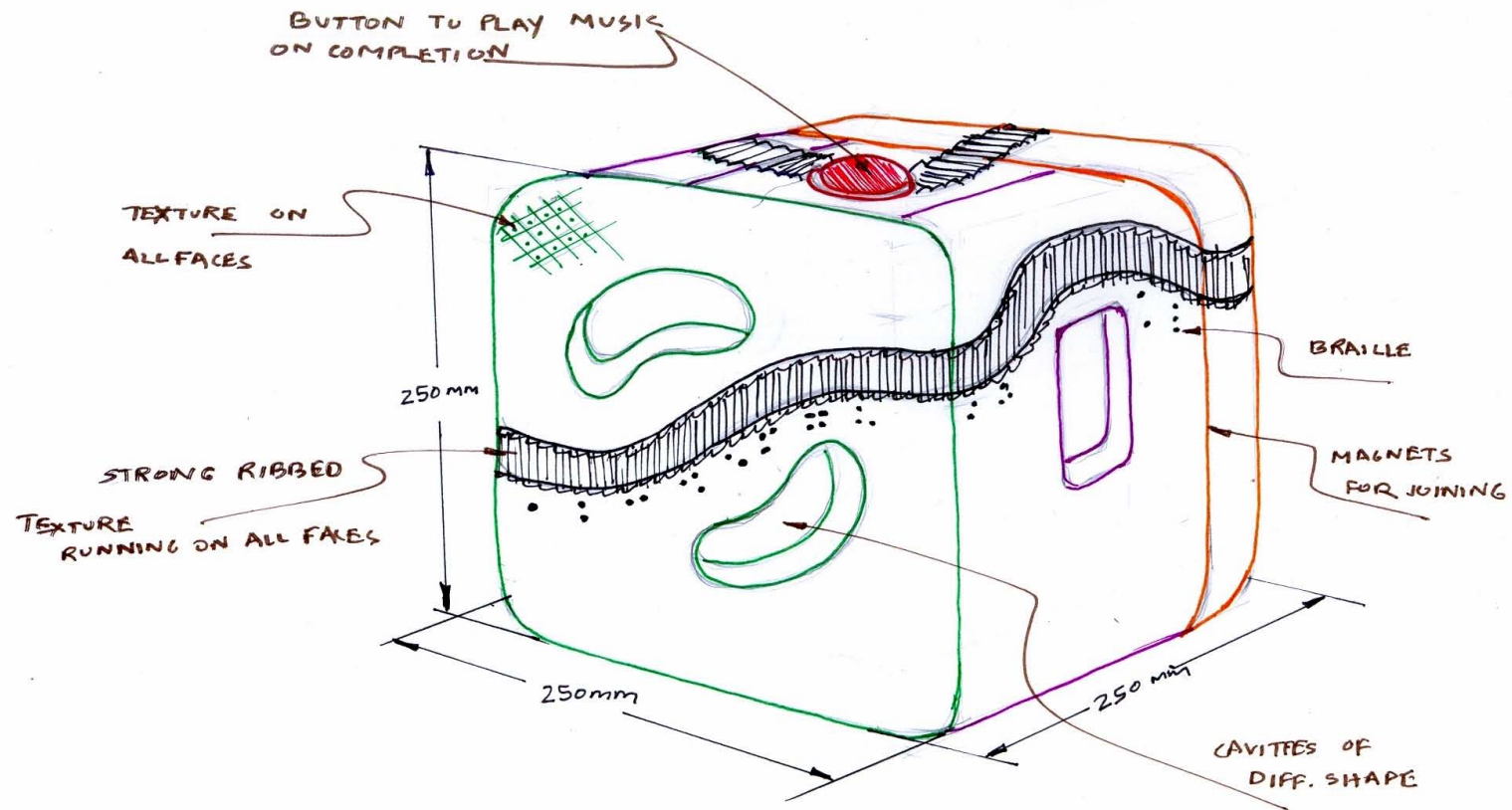


Fig 8.1



CHAPTER 8 **Final Concept**

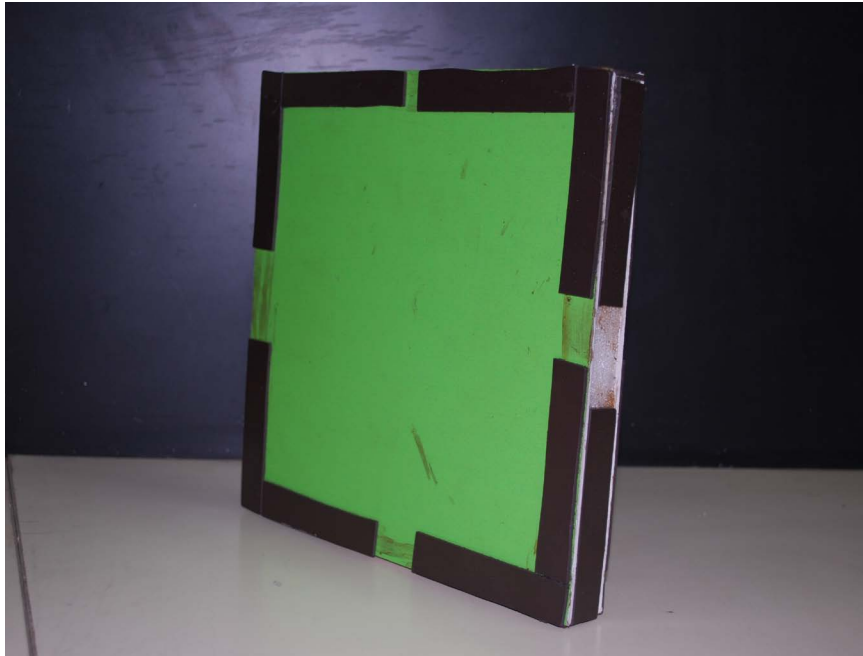


Fig 8.2

8.1 How it will work:

- The children will be given **6 panels** which are to be joined with each other to form a cube. This can be done **individually** or in a **group**. Fig 8.1 shows the **initial ideation** for the concept.
- Based on the **feedback** I got from the **mock up testing** I decided to keep the the **size of the panel** as **250 mm x 250 mm x 25 mm**. Fig 8.2 shows the mock up piece made of foam board and polyurethane foam between the boards and flexible magnets on the edges. The **over all size** of the cube would be **250 mm x 250 mm x 250 mm**.
- The **face** of the **panel** will be **textured** on which a **strip** having **ribbed texture** will run on the **front face** in a **particular pattern**.
- There will be **magnets (buttons/ flexible)** on the faces which will make it easier and **convenient to join** and remove the panels.
- The panels will have **cavities** of different shapes on the faces. The **primary function** of these cavities will be to provide a **gripping surface** to **join** and **remove** the **panels** with each other. The **secondary function** will be to expose the child to different kind of **shapes** and learn different **spatial concepts** like **scale, symmetry, pattern, opposite, diagonal, equal, negative space, alignment** etc.
- The panels are to be **joined** in such a way that the **ribbed texture flows from one face to other face continuously**. i.e. the end point of the **texture** on one panel should **match** with start point on the other. The **child** will **touch and feel textured path** of the strip running on the face of the panel with his **fingers**.
- There will be **Braille letters/words embossed** on the face along the strip which will give a **clue** about the next panel that needs to be connected. For e.g. one of the panels will have the letters **A,B,C,D**. In order to connect the next panel correctly the child will have to **search** for the panel which has the letters **E,F, G and H**.
- The child has to keep on working on it till he forms a **closed loop** running through all the faces of the cube. There will be only **one correct combination**. The panel will have an **electronic circuit** running inside



it which can be **activated** through the **button** only when the loop is completed. Pressing the button will **play a music** giving child the **feedback** that the **puzzle** has been **completed**.

- One of the **flaw** in the above mentioned idea was that **three different shapes of panels** will be required to form the cube, and **flat side faces** would make it **easier** to solve the puzzle. With an intention to **reduce the no. of shapes** and make the puzzle more **challenging** I decided to keep a profile that made four of the six panels **interchangeable**. **Fig 8.3** shows the **profile** of the panel.

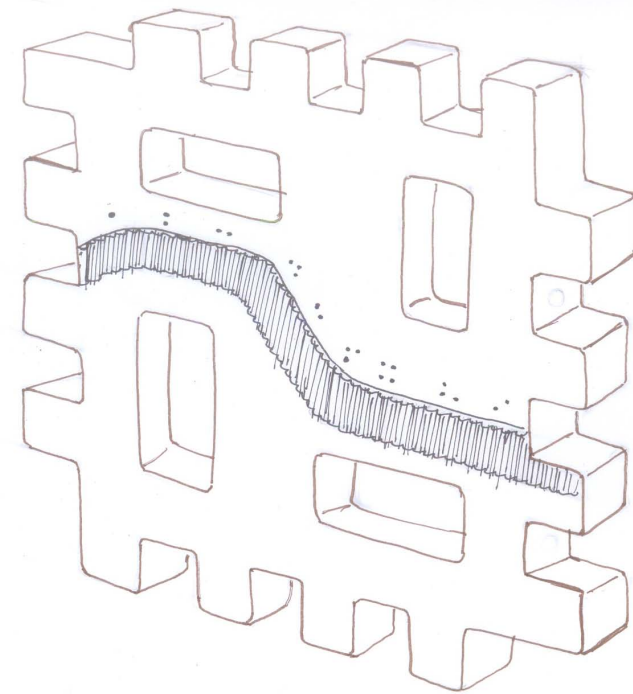


Fig 8.3



Fig 8.4

- The puzzle will have **three levels of gradually increasing difficulty**. Fig 8.4 shows how the puzzle will look like on completion.
- In the **second level** the child will be required to make a **cube** in which the panels will have **two kinds of textures** instead of one. There will be **rhyme** in Braille instead of the alphabets.
- The **third level** will be further complex having **3 different kinds of textures** that need to be connected correctly to complete the loop.
- Once the child completes all the three cubes it can be **stacked on top of the other to form a tower**. The child can play three different kinds of music and simultaneously feel different texture on the panel faces.

8.2 Benefits of using the kit:

- This will **improve the ability** of the child to **track with his fingers** that will help him in **learning Braille**.
- This will give him an opportunity to **learn Braille** in a playful way.
- **Reward** is in the form of **music** which plays if the cube is made correctly.
- **Multi-sensory experience** through the means of tactile and auditory feedback.
- **Improvement in orientation skills** by learning to **align** the panels in the correct direction.
- **Improvement in social skills** when the **child interacts** with **other children** while playing with the kit.
- **Understanding cause and effect** phenomenon when he plays the music on completion.
- **Improved spatial awareness** by manipulating the **2D shapes to form 3D structures**.
- **Improved kinesthetic sense** due to **movement of body parts**, especially when the child **stacks the cube on top of each other**.
- Understanding various **spatial concepts** like **scale, symmetry, pattern, diagonal etc.** through the cavities on the panels.



8.3 Product Features

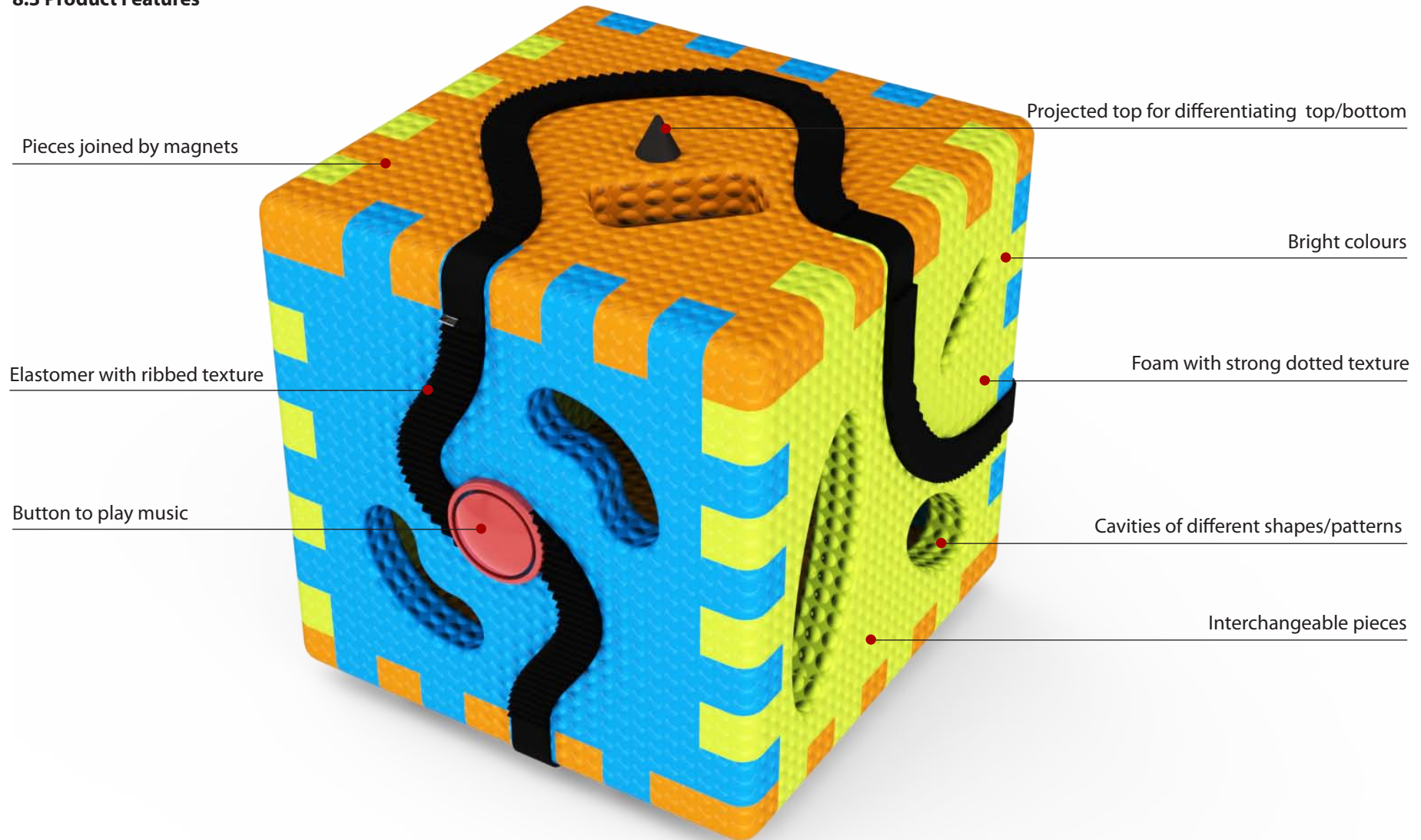
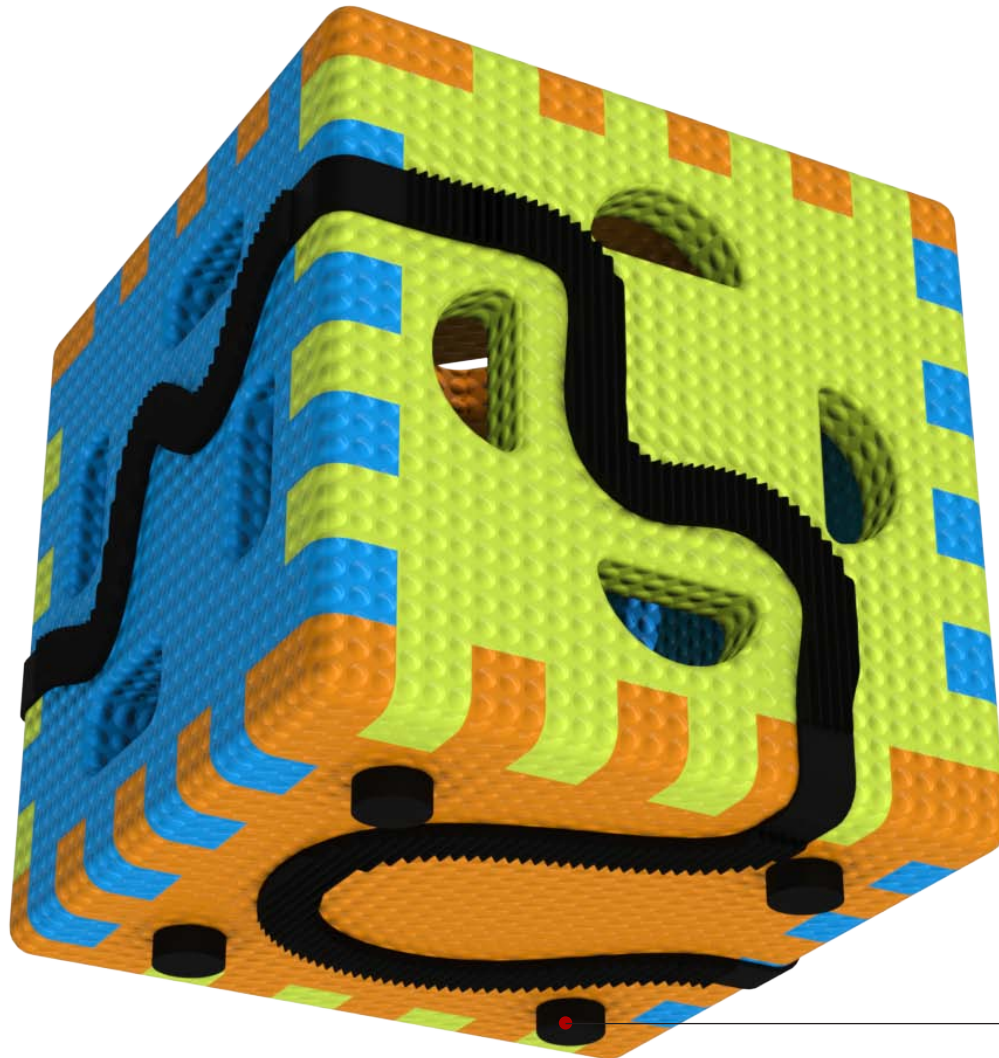


Fig 8.5



Fig 8.5 and 8.6 show the salient features of the product



4 bushes for stability/identifying bottom panel

Fig 8.6



Fig 8.7 shows the exploded view of the kit.

Fig 8.8 shows the size of the panel w.r.t to the child.

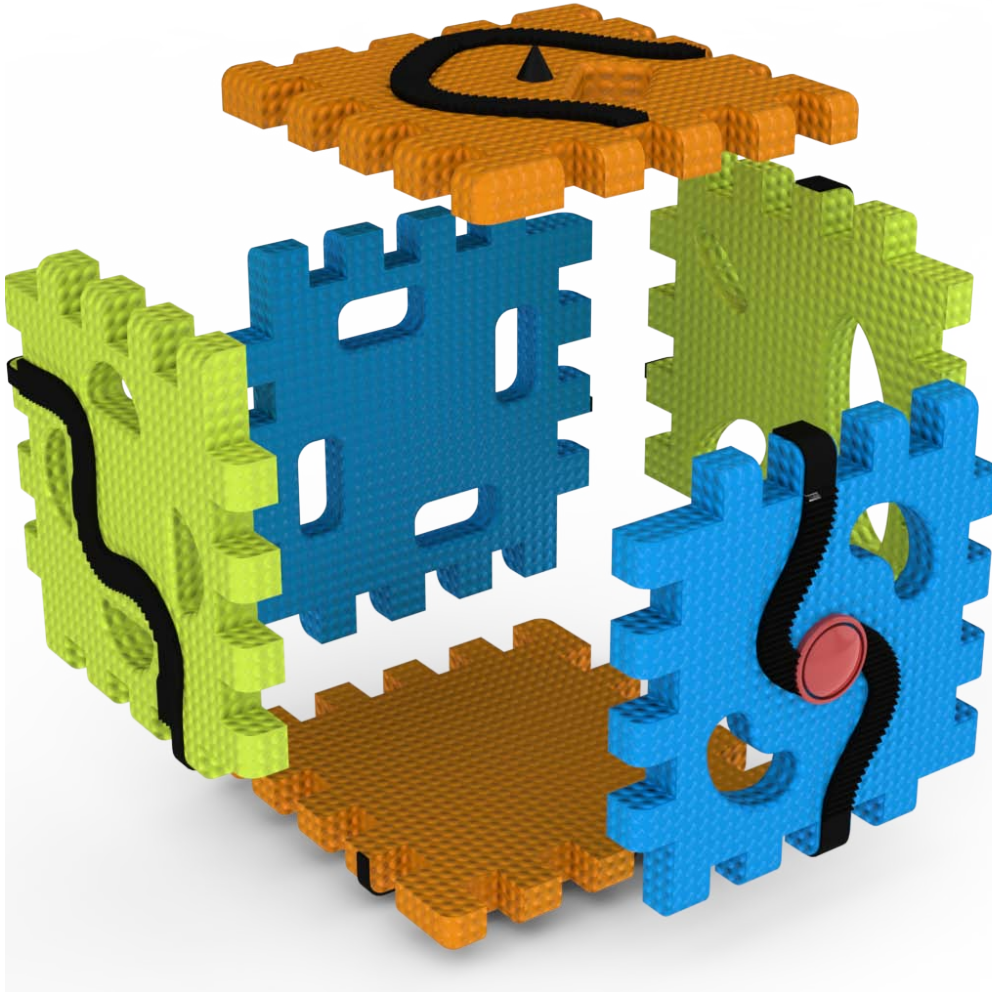


Fig 8.7

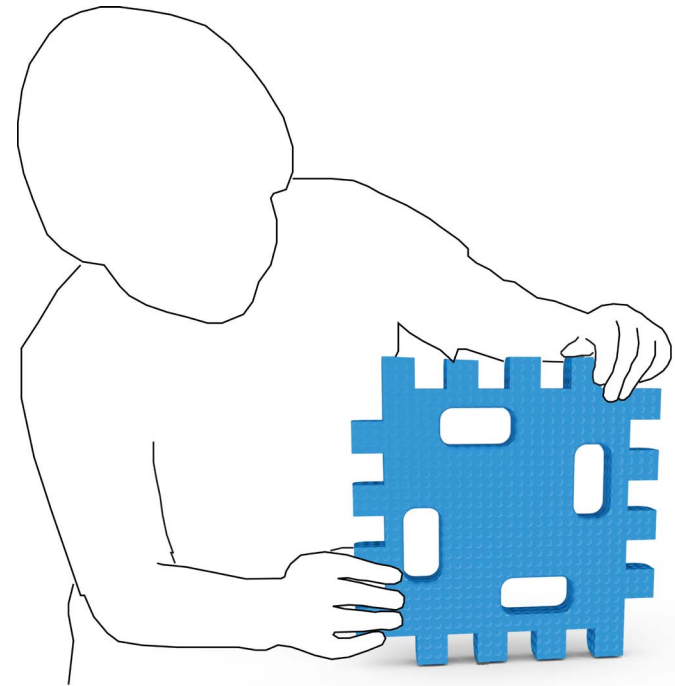


Fig 8.8



Fig 8.9

8.3 Future Scope for the project:

The kit was not tested with the children due to the time constraints and difficulties in making a working prototype.

The kit was not tested with the children due to the time constraints and difficulties in making a working prototype.

As the kit is meant for a small segment, a cost effective approach is to be considered. Methods like injection moulding will be expensive as it will require the kit to be mass produced.

The proposed material for the kit is PVC foam board which are available in sheets. These sheets can be punched with dies to get the necessary shapes.

Button magnets/ magnetic rubber sheets can be used to assist the joining of pieces conveniently.

The circuit can be embedded inside the textured rib running through the panel faces.





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