



# Designing for Children

- With focus on 'Play + Learn'

## Primacy of human centric design in the development of an educational toy for visually challenged children: A case study

Jayakumar, M, M. S. Ramaiah School of Advanced Studies, Bangalore, India,  
mr.jayakumar@gmail.com, jayakumar@msrsas.org

**Abstract:** The development of products that cater to the needs of children is beset with its own set of challenges. The challenges quadruple when we factor in, the needs of visually challenged children, as there is very limited knowledge repository to depend on and also, very few marketers cater to this not-so lucrative segment from commercial perspective. Keeping these aspects in mind, we designed a toy which facilitates a faster learning process in these special children. As George Bernard Shaw once said “what we want is to see the child in pursuit of knowledge, and not knowledge in pursuit of the child “, this thought greatly inspired us during the entire course of the development cycle of this toy.

**Key words:** ethnography, prototype, usability, Braille

### 1. Introduction

India has a highest number of visually impaired or challenged children and their number seems to be growing unabated. Besides, the lack of infrastructure to cater to their special needs, there is also total apathy and insensitivity in our society towards these children.

Post economic liberalization of our country, there has been numerous products flooding the market but hardly few products catering to the needs of these children. So there is huge gap and this needs to be addressed on a war footing to promote their holistic development.

Our product (prototype) specifically caters to the educational needs of these children by facilitating and enhancing the learning abilities.

Design research is the pivot around which all the design related activities revolve. It is of utmost importance as it determines the specific needs, aspirations of the user group. A well-formulated design research strategy is critical to the success of a product or service in meeting the customer needs.

Keeping this aspect in view, a group of product design students from M. S. Ramaiah School of Advanced Studies undertook a project relating to the design of an educational toy for differently enabled children.

The project results clearly elucidate the importance of design research, as the user inputs were incorporated at every level of the output process. The user aspirations were translated into reality and the product elicited encouraging response from the user community.

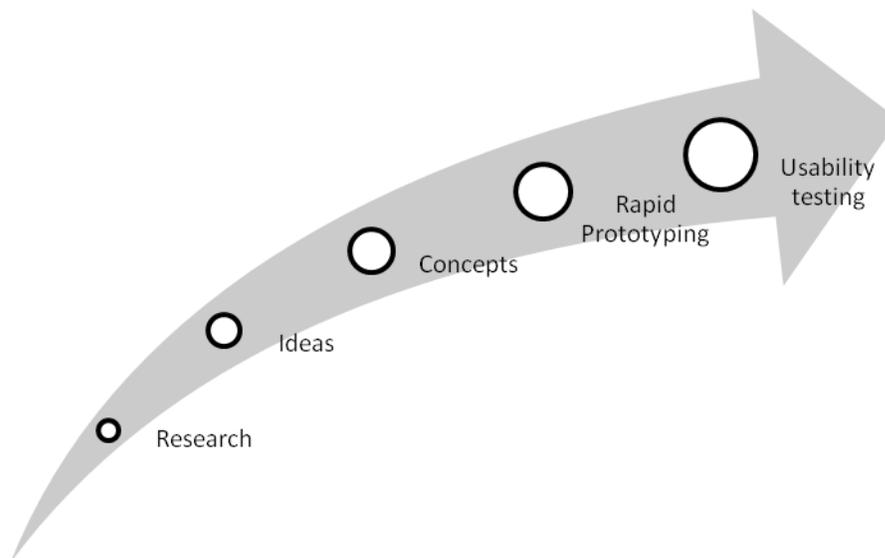


Figure.1 Design Process

## 2. Research

As the product was to cater to the visually challenged children, it required a paradigm shift in our thinking, mind-set and approach. Therefore, the Research process was rolled -out in two segments to gather all the possible insights.

### (i) Secondary research

In this phase all the sources of available information such as books, journals, web search etc was carefully gleaned through. This enabled the research group to gain understanding of the psychology of these children. It also consisted of the review of the toys available in the market catering to their needs.

### (ii) Primary research

The striking feature of the primary research has been the well-documented observations of the visually challenged children with the help of pictures and videos. The research group visited the various blind schools located in Bangalore to undertake this study.

The specific findings of the study are stated below:

- Learning is primarily through the senses of sound, touch and feel
- Interdependence gives a sense of security, they prefer to be in groups and also love to play in groups
- They like to play outdoor games like cricket and indoor games like chess and carom
- They learn their subjects through Braille books and love to listen or read stories from the Braille books
- Singing, learning and playing musical instruments are their favorite activities and learning subjects like mathematics, science and languages score low in their interest level
- They are disciplined and follow instructions diligently, their thought patterns and actions are well organized
- There is sense of hesitancy in terms of meeting new people, trying out new things etc. However, once accustomed, they readily adjust to the environment

- Their movements are slow and are very cautious at every step they take
- Response to sound is quick
- They use toys that normal sighted children tend to like and they like to play in groups
- At school when games are conducted and the results are declared, they exhibit greater happiness in winning the games. The feeling of being a victor or victory motivates them to give their best
- Unlike normal children they possess great sense of touch, and high level of concentration
- They use Braille to write and read, the direction of writing and reading is left to right and right to left respectively
- They display keen interest in activities related to culture and art

The concluding outcome of the research has been the ability of these children to learn faster when the knowledge is imparted through the medium of activities consisting of “games”.

This provided the basis for the research group to design a toy which could create interest and enhance the learning abilities of these children.

Certain key parameters were broadly outlined in the design of this toy and these are:

- Safety is the first preference for any product that is used by the children; in case of special children the consideration for safety is manifold
- As the vision is impaired, the usage of the toy needs to be simple and uncomplicated
- These children prefer to play in groups and the toy should be able to accommodate more than one child in its usage resulting in a “group” game
- It should be able to generate interest in mundane subjects such as language and mathematics
- Requirement of bright colors, high contrast and light emitting products was felt, as that would be more beneficial to partially blind children
- It needs to enhance their motor skills

- Variety of appealing surfaces and textures arouses the curiosity among the children, this also need to be factored in
- It should stimulate their creative skills
- It should also promote co-operation, concept of sharing, social growth, develop awareness of people, places and things

### 3. Ideation

The broader parameters were further analyzed to arrive at a basic framework. The guidelines of framework are as under:

- A toy that enhances the vocabulary of the visually impaired children
- A toy that encourages the children to win the game, thus making them to understand new words in English language
- Increase the motor skills of the children that would help them to grasp the alphabets in less time
- A competitive atmosphere that would enable the children to take on challenges and get a sense of appreciation for every game they win
- ‘Fun+Learn+Win’ is to be the theme for the toy

Subsequently Ideas were generated for a toy that blends fun, learn and win. Multiple concepts were generated and few of those concepts were further refined through the deployment of the CAD models.

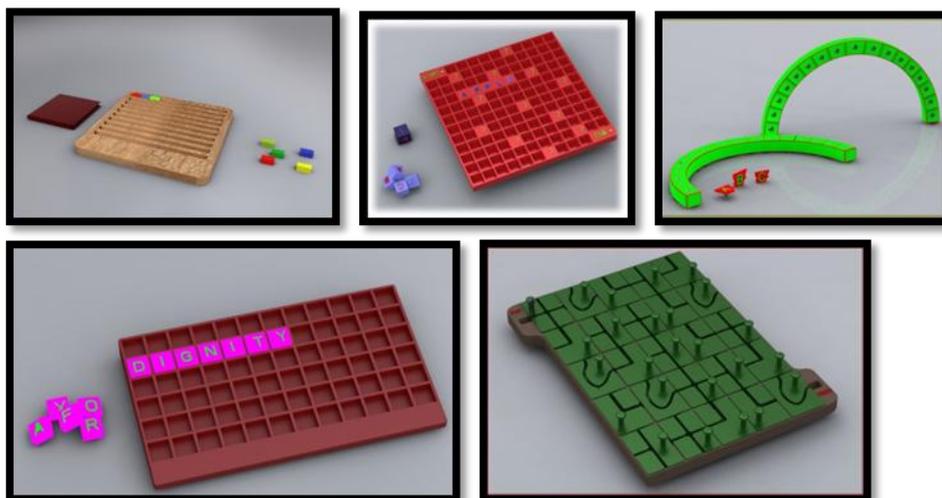


Figure.2 Concepts

The concepts were explained to the users, based on the feedbacks the 'train toy' was selected.



Figure.3 Selected Concept

This is primarily a two-player's game. The minimum letters in a completed "word" should be three and after winning the letters, they need to rearrange the letters in their respective positions to avoid searching for the next time. The formation of letters should be from left to right.

While placing each letter, they should think of forming a word. In the course of forming the word, if one player completes the word, he will challenge the other to form another word using the same dots, without disturbing the position of the letters.

For example if one player forms a word 'friend' then the opposite player has to form another word from the existing letters to win, so he keeps the letter 's' and the word becomes 'friends'.

It is to be noted that the rules of the game expressly prohibit the usage of "plural" words and also the "names" of persons.

However, the second player mentions that the word ‘friends’ is just the part of the word he has in his mind. The process continues and finally the player who wins is the one who completes a meaningful word, in this case it may be ‘friendship’.

Further, if a player completes a word and the other player is not able to form a word from the existing letters, then the winning player will take the cubes attached to the train engine. This process will go on until they finish the game.

The player should have all the letters to form a word; this process will go on until a complete word is formed.

In the letter forming process, a player can quit any time and the letters kept will be taken by the other player. When one player wins, the other player loses few alphabets, after this, the player who has lost the cubes has a challenge to complete words with the limited alphabets. Finally, the winner should be able to take away all the cubes from the opponent and thus gets the engine.

The left side of the cubes is fixed with an iron plate and the right side with a magnet. The underlying principle is that usually children enjoy playing with magnets and for the visually impaired the magnets would help to attract the other cubes with ease.

#### 4. Prototyping and Usability Testing

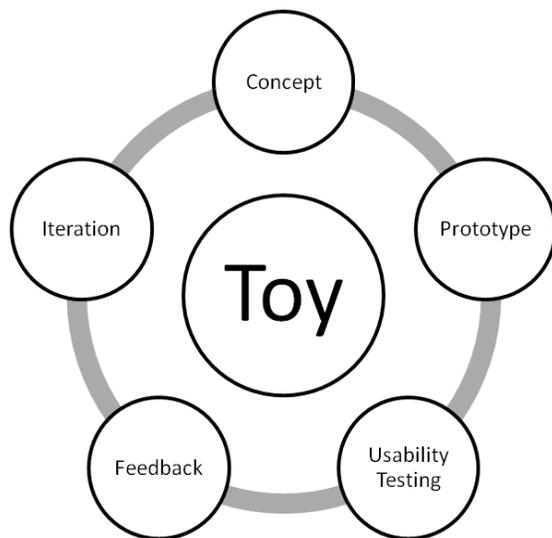


Figure.4 Prototype and Usability

The concepts developed through CAD models were put through rigorous tests to evaluate their effectiveness. The prototypes were made available to the users and their inputs greatly helped in ironing out the thorny issues and in enhancing the design of the product.



Figure.5 Thermocol Prototype and Evaluation

The specific inputs that emanated from this exercise are mentioned below:

- Difficulty in playing the game, sitting opposite to each other
- Difficulty in aligning compartments in straight line
- Flexibility in playing as an individual and group
- Distinguishing between each other's alphabet cubes
- In case of blind children the requirement of reference for aligning the cubes was felt
- Letters should be projected only at the top
- Confusion arose on using plurals, names of person and place
- Most importantly the blind children were finding it difficult in locating the right cubes

The second prototype was made using 'MDF wood', giving due credence to the elicited feedback. The alphabets were made using Braille. It was determined that the visually impaired students would find it difficult in reaching for the right cube and thus decided to provide a fixture. The fixture has reference blocks which are fixed and next to it are the cubes with a metal on the bottom and magnets on the sides. The magnets

are fixed in such a manner, so that no two magnets from two different cubes could attract, as they all are in the same poles which enables them to repel.

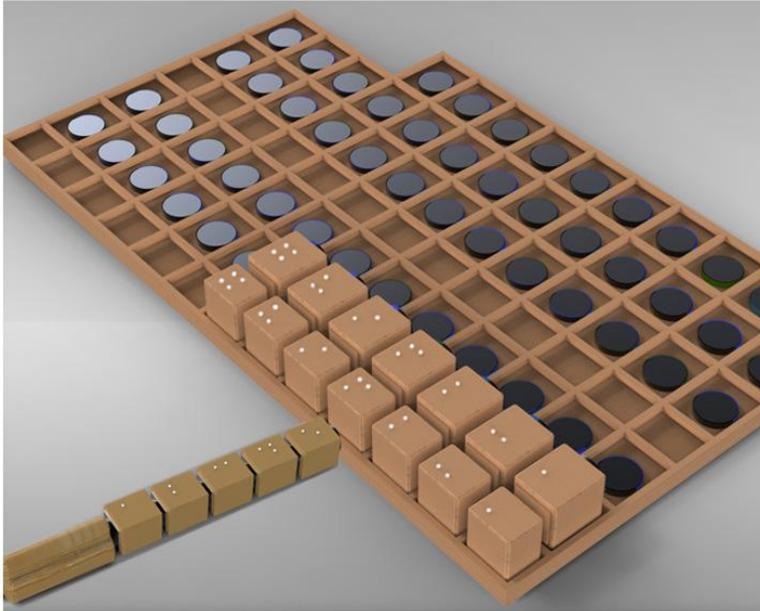


Figure.6 Prototype from MDF wood

The prototype was subjected to usability testing. The game was played with the blind school teachers and next the game was played by the visually challenged children.



Figure.7 Usability testing

Feedback from the blind school teachers:

- This game requires to think more new words and spelling, the game helps to improve their vocabulary as it triggers one to learn new words to win the game
- The toy is simple and the children love to play the game
- Referencing in vertical axis is comfortable for kids
- Weightless material can be considered for the cubes and wood or plastic texture is preferred

Following are the observations from the usability testing:

- The fixed reference blocks are similar to the cubes, so they are often confused to be cubes and the players tend to take it out from the board. So the reference blocks are to be different from the cubes
- The visually challenged children are familiar with English alphabets, other than Braille, English alphabets should be embossed on the cubes
- The size and proportion of the Braille dots were not taken into consideration. The Braille imprints should follow the standards in the final design
- There should be referencing for individual cubes, this would enable to orient the cubes in right direction
- On the fixture the magnets are projected out, in the final design the magnets should be merged with the board

The above points were taken into consideration and the new design was proposed. The prototype of the final design was made using acrylic, plastics and wood. Acrylic was used for the fixture, plastics were used to emboss the letters and the wood was used for the cube. Again these materials were chosen for the cost effectiveness and to reduce the prototyping time.

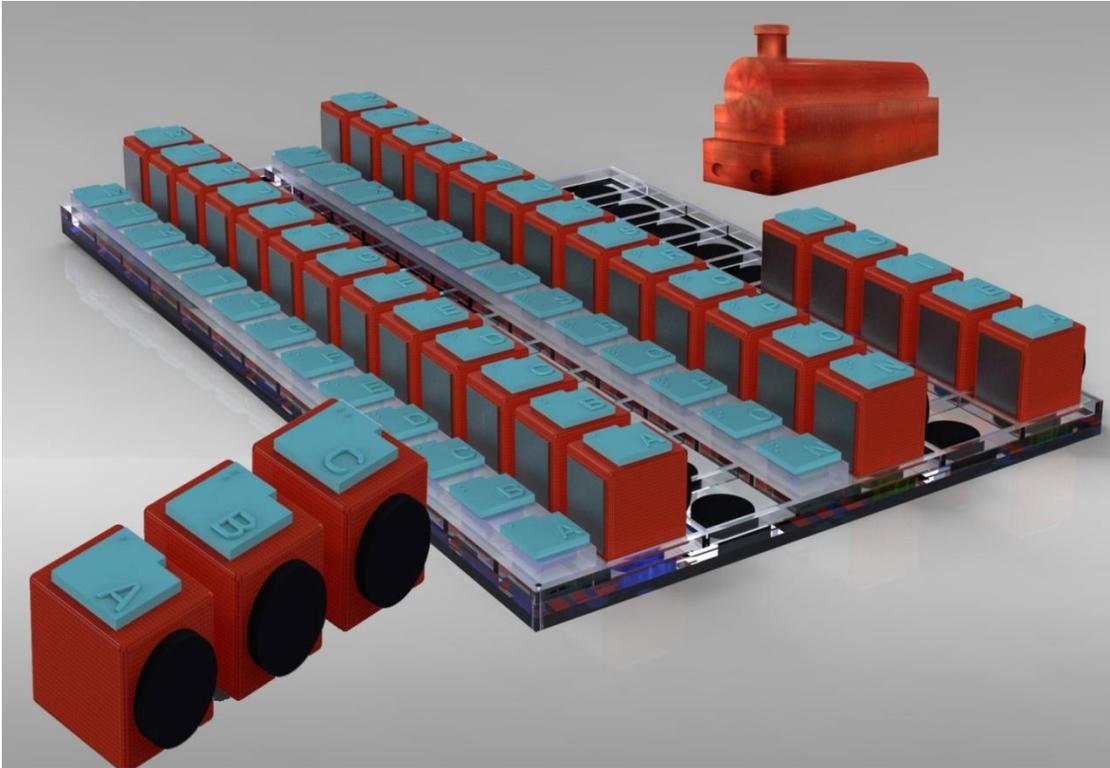


Figure 8 CAD model of the final design

The following are the corrections made in the final prototype:

- The size, pitch, and projection of Braille dots and alphabets are standardized
- Magnets were merged with the fixture base
- Reference blocks are shifted down and can be easily distinguished from the cubes
- Magnets fixed on the cubes will repel each other
- Clear and specific referencing was made for every block
- Adequate clearance was given for the slots for easy pick and placement
- Material type was determined for the final design considering the weight factor
- Player identification was given for easy understanding
- In the letter forming process a player can quit anytime and the letters kept will be taken by the other player
- When one child wins, the other child loses a few alphabets, and from there onwards he has to think of a word with the existing alphabets. This would spur him to win the game the next time, to balance the alphabets

- The process will continue till he/she loses all the dot/s or else he will have to accept his/her defeat, or the game can be played in terms of rounds
- One who wins the game wins the engine



Figure 9 Final Prototype

## 5. Validation and Conclusion

The final prototypes of toys were deployed and tested in the blind school. The visually challenged children used the toy and found the game to be interesting.



Figure 10 Visually Impaired children playing with the toy

It was also noticed that sense of achievement was clearly visible on the children's faces whenever they emerged victorious in the game. The teacher's were also gung-ho on the role played by this toy in enhancing the effectiveness of the knowledge delivery mechanisms for this special children. Further work is being carried out to make the product commercially viable, new concepts are designed to eliminate the fixture, make the product light weight and reduce the cost.

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