

# Design and Development of Musical Toy using Shape Display Board

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## ABSTRACT

The project focuses on the Design and Development of Musical Toy using Shape Display Board. The design of the product aims to provide a musical toy for children between the ages of 3 – 5 Years to promote Cognitive Development. Factors like safety of the child, ease of use are also considered while designing the product.

The Aim and objective of the design of the musical toy is to incorporate suggestions and improvements of the musical toy by understanding the problems faced by the child and the parents in the existing musical toys. The process of designing incorporates multiple steps which include literature study, material study, case study, location study, user study, market study, patent study & working of the toy to obtain the final product.

These studies include understanding the existing problems in the toys, need to promote cognitive development in the child and the overall life of the toy.

The final product results in a highly fun musical toy which contains various shapes and is colorful. This also resolves some of the problems and suggestions given by the parents and the children like bigger size shapes, more colorful design and a unique toy. The Sketches of the concepts were made with manual drawing & Sketchbook Pro, and the virtual model was made of Autodesk Maya to achieve a realistic render. The exterior part of the musical toy is made from Polypropylene Plastic, which is highly durable, non-toxic & child friendly while the internal parts are made of mild steel which is efficient in nature.

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## I. INTRODUCTION

The project focuses on the Design and Development of Musical Toy using Shape Display Board. The design of the product aims to provide a musical toy for children between the ages of 3 – 5 Years to promote Cognitive Development. Factors like safety of the child, ease of use are also considered while designing the product. The initial process is literature study which includes Musical Toy Research, Tune Study, Shape Display Board Study, and Light Study. These were collected from Articles, E – Newspapers, Books, and Journals. Data collection & Analysis of the project plays an important role in generating ideation sketches, finalizing the concepts & selecting the concept. Data Collection was done through Market Study, Product Study, Patent Study, Location Study, Material Study, User Study, and Case Study. Analyzing the data collected lead to exploratory sketches, brainstorming and mind mapping. The evaluation of brainstorming, mind mapping and exploratory sketches lead to the concepts and selection of the final concept.

The selected concept is then visualized using Maya to better explain the usability and functionality of the product. The dimensional detailing is done by conducting an Ergonomic study of the product using Anthropometric Values taken and is virtually modelled using CATIA software. The Materials are then assigned to the Virtual model present in Maya to provide realistic renders, context renders and cut away view of the product. This helps understanding human and product interaction while also showing the internal components present in the product. An animation video is generated to show the working of the product, this is done using Maya & Adobe Media Encoder. All of these help in understanding the effectiveness of the product and meeting the expectations of the consumer. Feedback is taken to improvise the product while developing as it helps in the real-world use while also adhering to the requirements of the consumers. To create a realistic model of the natural population and their related threats a methodology is generated in this paper, which applies the principles of population analysis, threat identification, and risk impact determination.

## **II. LITERATURE STUDY**

### **2.1 Classification of Musical Toys**

Musical interactive toys motivate interaction with the toys and other people as children when interacting with toy brings lights up and while also playing music. It is widely popular with parents whose kids age range from 3-5 years as it simple to use with an added benefit that it promotes their child's motor function. Musical instruments are typically introduced to children at a very young age (3-4 years) to play tunes and notes that support development of both gross, fine motor skills and sense development in the child. This assists the child and helps them develop self- confidence, decision making and keen listening skills. Musical figure toys, are usually in the form of figure or character from a game or shows and are often a child's first toy and are identified through their theme songs that is played. These play an essential role for helping children learn to identify colors and shapes, as well as for understanding the rhythms and tunes the toy produces. Musical projectors, these project scenes from nursery rhymes while playing audio and help children fall asleep. With their limitation in the number of rhymes, when the projector faces upward and begins to play, it creates a soothing experience for the child.

### **2.2 Effectiveness & Importance**

It promotes creativity as children are very curious and will enjoy exploring different sounds as they are produced. With creativity it also enhance their cognitive skill and help build sensory recognition through pattern and rhythms of music that helps the brain to transmit information in a quick and effeicient manner. This results in language development, speech, listening and reading skills. It encourage child to be more self-expressive as children cannot usually use their vocabulary to express themselves, musical toys helps them express themselves and how they are feeling at that moment. Finally, one of the most essential benefit I improve fine motor development as the child are required to pick the toy, pinched and grasped for it to play a tune or move the toy around for a musical note, this requires the kid to move its fingers and hands which helps in the development of motor movement.

### **2.3 Tune Study**

The use of musical toy there are limited tunes that can be used as loud tunes tend to affect a child's hearing and makes it cry. Exposing children to music at a young age helps them strengthen their grasp of words, sounds and nursery rhymes for better memory. Slow tunes are used to help develop the skill for language, overall literacy and intellectual readiness to school, while fast tunes help in dance, promotes movement of the child's body based on the rhythm and help them have a social-emotional interaction while increasing their motor skills.

### **2.4 Light Study**

In musical toys lights are added to create an interest, usually done through flicking the lights. Most of the toys use LED's lights as these are much safer, don't heat up easily, last for a longer duration and are power efficient. They are powered by AA or AAA batteries; in rare instances some use incandescent light sources prominent in nightlight projectors. The brightness of these lights remains high and no provision for adjustment. Majority of the toy have their light sources spread across the toy for a uniform distribution. Some toys use LED strips as an alternative to lights for cost saving purposes. Light sources are either present inside the toy or are protected with a transparent plastic to prevent direct contact by the child.

### **2.5 Shape Display Board Study**

These are usually used in Grade I and II in mathematics subjects to help understand various geometric shapes as it helped encourages the child to touch and feel the shapes. This helped the child in visualization of the shapes and try recreating them using different materials. With shape learning they also associated the shapes to certain colour which help them easily identity them either through touch or from visual appearance. While using this it helps the child improve their hand eye coordination and help increase their memory.

## **III. PROBLEM STATEMENT**

The initial stage of the project is to conduct literature study on existing musical toy and observe how children are interacting with these toys to get ethnography finding and understand problems present in the product and how it can be improvised. The target age group is 3-5 years, mainly targeting children who are learning how to operate a toy. Through the finding we will conduct research of current toy trends and understand their material incorporation. To design and develop musical toy using shape display board for children to promote cognitive development. Through the research stage, we develop ideation sketches, which are narrowed down to one selected concept and a detailed product detailing regarding their functionality and ergonomics is created. This concept is them made into a digital 3D model, photo realistic render and context render. Finally a working model is created of the selected concept.

### 3.3 Methods and Methodology

**Table 1: Methods and Methodology**

Objective No.	Statement of the Objective	Method/ Methodology	Resources Utilised
1	Literature Study	Reading	Books, Journals, Articles, Thesis
2	User Study	Questionnaire Survey	Online Forms
3	Market Study	Reading	Articles, Journals
4	Ideation	Mind – Mapping & Brainstorming	Mindz Pro Application
5	Ideation & Concept Development	Sketching, Form Exploration	Manual Tools, Sketchbook Pro
6	Concept Detailing	Digital Rendering, Drafting	Sketchbook Pro, Photoshop, Autodesk Maya, CATIA V5
7	Ergonomics Study	Parameter & Analysis	Anthropometric Database of the Preschool Children from 2 to 6 Years in Taiwan
8	Product Visualization	3D Modelling, Rendering & Animation	Autodesk Maya, Adobe Media Encoder
9	Product Poster	Digital Composition	Adobe Illustrator

### IV. DATA COLLECTION AND ANALYSIS

Data Collection and Analysis is the collections of important data about the topic which has been done. This is done to utilize the data collected for research purposes and analyze it. The Data collection conducted here were Product Study, Market Study, Location Study, Material Study, Case study, User Study and Online Survey.

#### 4.1 Case Study

The feedback provided for musical instruments were that they were easier to use and play, harder to create a tune initially but over a set period of time can, little heavy when compared to normal toy. They are very delicate in nature and can break if not taken care of. These instruments were used children who age ranged from 3 – 12 yrs. (can go higher if there is an interest). The major problem that was present was the cost of the product as it is an expensive investment. Some of the improvements that can be incorporated were that having a dedicated recorder built into the instrument to record music instead of an external device would be beneficial. The feedback provided for musical interactive toys was that they are very interactive products as they are great to play for long hours. The light which glows from the toys is much more visible during the night. The sounds quality of these toys isn't great but can be heard. These are majority used by children who's between 1- 4 yrs.

The problem is that the light being used isn't visible in bright conditional. Some of the improvements would be making the sound louder and increasing the brightness of the light in the toy. The feedback provided for musical figure toys was that they make very cool sound effects while playing as parts of the toy are moveable making it very engaging. There are lights on the toy which light up and make different patterns of light based on the mode. These figure toys are used by children ranging form 3-7 yrs. as it stimulates their brain with various interactions. The major issue is that these are extremely fragile and if not taken care can snap easily, some sounds are extremely loud and similar to the interactive toy aren't bright enough in outdoor conditions. Some improvement factors would include have a volume slider and higher toy quality.

#### 4.2 User Study through Online Survey

The survey provided give us insights into the use of the toy and children feedback on them. The majority of the users were boy making up 77% while the remain were girls. The age group of these children were 2-7 yrs. The feedback provided from these children were that they were happy with the toy that they used and were enjoying the various color options present. The tunes were enjoyable and they appreciated the sound quality in the toy. With some use, most of the children were able to understand how to operate they toy which in turn made the child more curious and interested in playing with them. There was another survey given to parents and siblings to understand their feedback on the toys their child or younger sibling were using. Majority of them were musically inclined and all of them had positive feedback towards the musical toys that were used as it improved their child growth. The material of the toy was majorly making up 77%. They all complimented the toy and told that it was worth buying. Majority of them didn't buy from a particular brand while some had store where they would

frequently buy the product. The major improvement which was suggested is to incorporate recorded rhymes instead of just sounds, reducing the product weight and improving the sound quality of the speaker and their positioning.

### 4.3 Ethnography Findings

Though the research it was found that larger shapes for easier pressing, there is requirement to improve the speaker placement and make the product light weight. The product should be compact in size with the incorporation of custom rhymes instead of default sounds and provide volume adjustor.

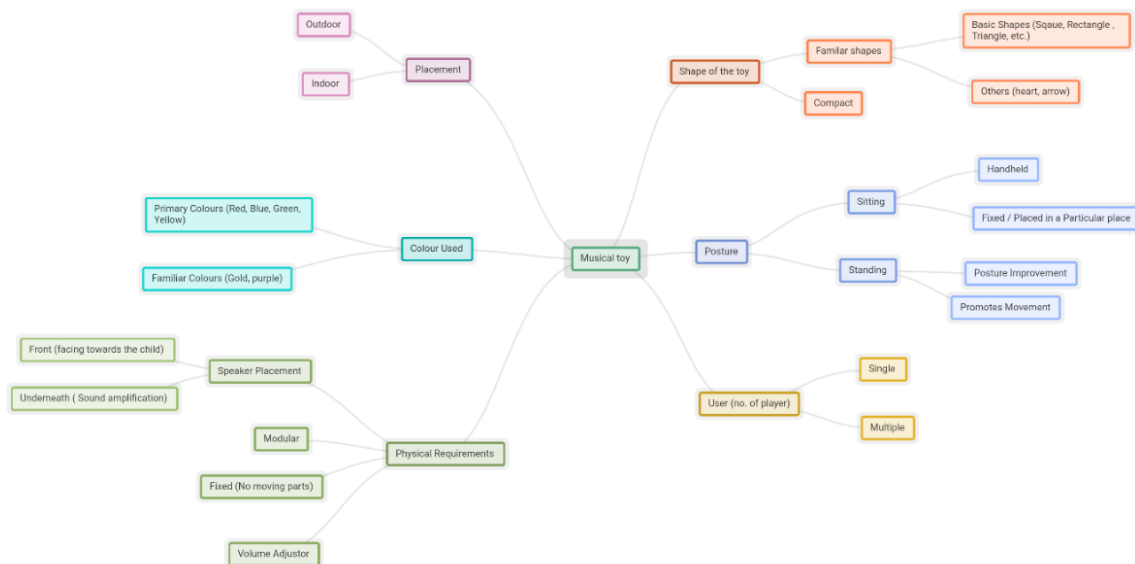
### 4.4 Conclusion

The Collected Data has information about Product Study, Market Study, Material Study & Case Study using Articles, Books & Journals, and E – Newspapers. The information regarding Case Study & User Study were done through Online Survey and In- Person questioning. This provided the problems which are currently faced by the User (Child), the current material information, the current brands which provide the product and the location at which they are played. This helps in bring a general benchmark of the products and to compare features to take the inspiration.

## V. CONCEPT GENERATION

Concept Generation aims to generate concepts that meet the requirements expressed by the Parents & Children this is done by using Mind-Mapping & Brainstorming, Visual Theme, Exploratory sketches, Concept Generation and finally selecting one concept. These are influenced by existing products. These concepts are further improvised and rendered in various software's.

### 5.1 Mind Mapping & Brainstorming



**Figure 1: Mind Mapping**

### 5.2 Ideation Sketches

The sketches generated is focused on a compact form factor to the musical toy with larger shapes and a much easier and intuitive way to play with. The sketches have taken the inspiration from existing products. These sketches also tackle the problems faced by parents and children and tries to improve them.



The concept was selected as it has a unique look to the musical toy which incorporates features from the push and spin toy. This concepts solves some of the major problems like the size of the shapes, weight of the toy & the ease to play with. In this concept the size of the shapes have been increased, since there are few internal components it makes the toy light weight and final the toy is very simple to play.

### 5.5 Conclusion

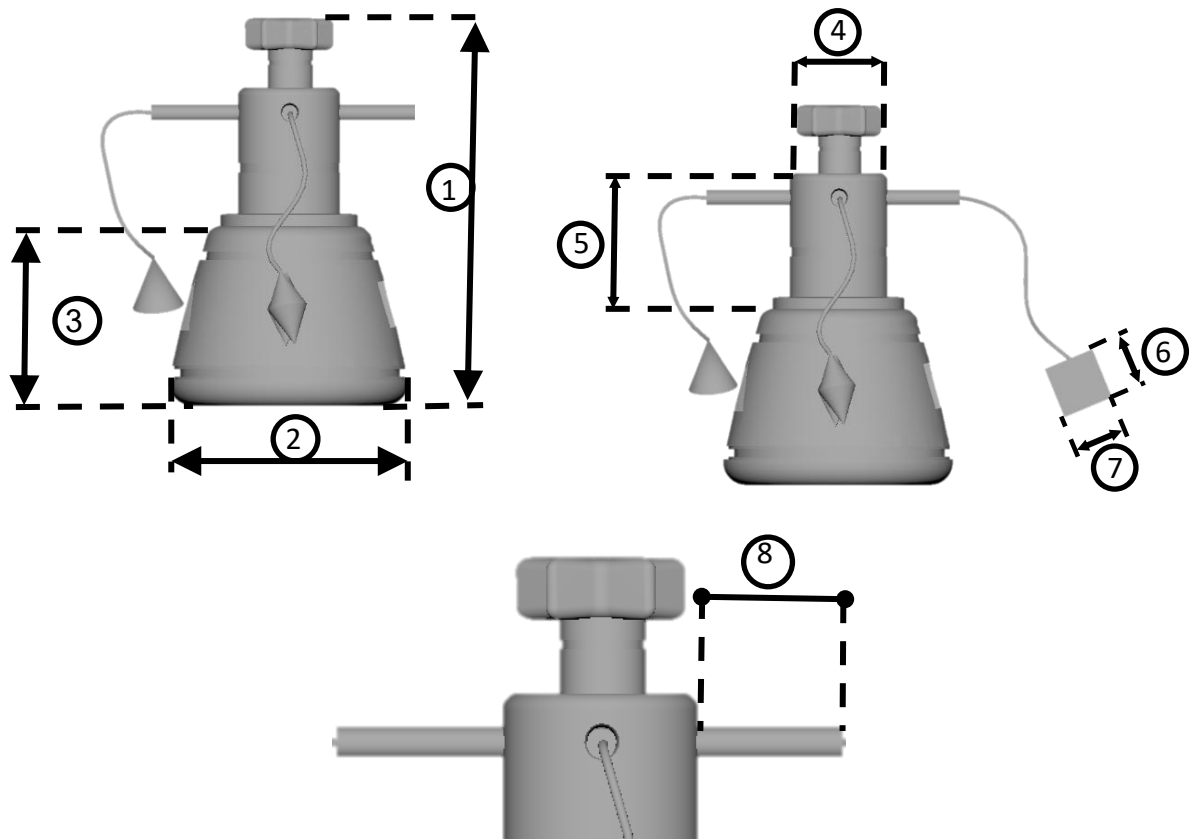
Concept Generation includes putting new ideas in the form of exploratory sketches to tackle the current product present in the market and its problems. After the exploration, different concepts were generated after considering the working and the internal working of the product. Finally a concept is selected which helps best tackles the requirements of the market.

## VI. CONCEPT DETAILING

Concept Detailing includes detailed virtual modelling, product context renders that represent the product with respect to the environment and humans, cut-away view which represents the internal components, the working of the product and finally Dimensional detailing for the Final concept selected. Concept detailing incorporate, aesthetic details, construction details, ergonomic study, functional details, structural details, and surface details of the product virtually. The aesthetic detail comprises the exterior look & form. The constructional details comprise the modularity of the product. The ergonomic study comprises of human factors with respect to the product and its use. Structural details encompass materials, parts, etc. The surface details include texture, colour, etc.

### 6.1 Dimensional Study

Dimensional study consists of human interaction with the toy and arrive at suitable dimensions to better equip the product to the need of consumer and ease of use. The Functional details comprise of height, width and diameter of each attached component present in the product.

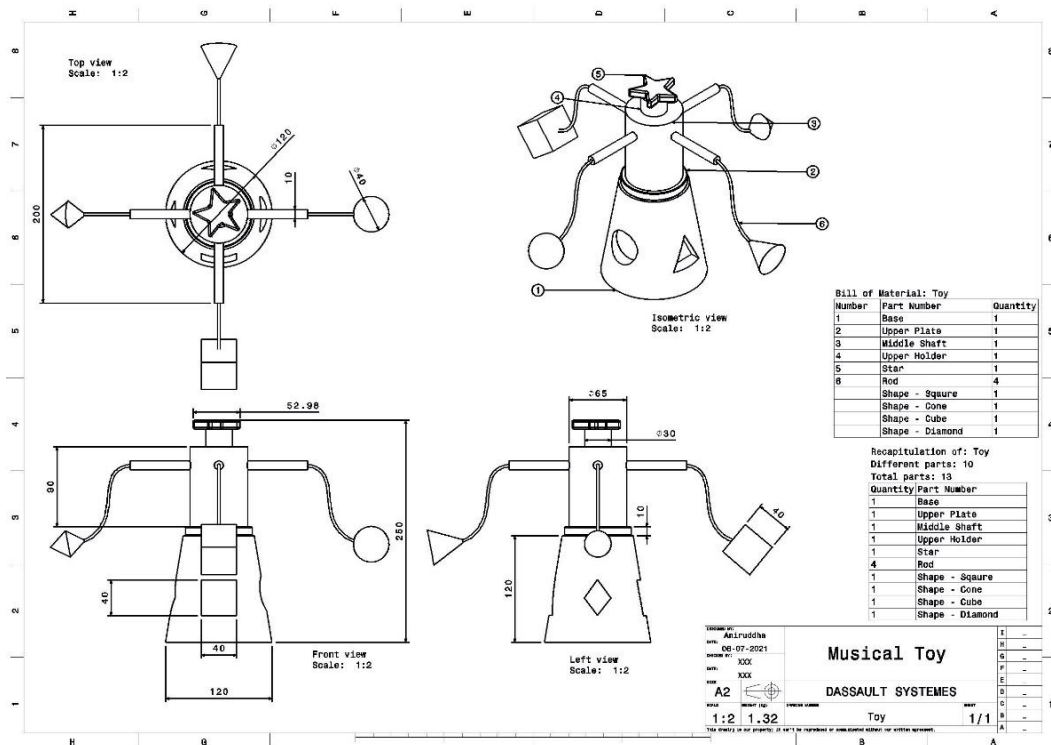


**Figure 4: Toy Dimension**

**Table 2: Product Dimensions**

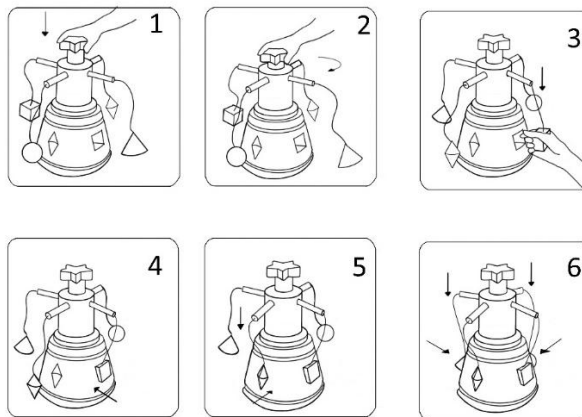
Sl. No.	Parameters	Measurements (mm)
1	Total Height of the Toy	250 mm
2	Diameter of the Toy Base	120 mm
3	Height of the Toy Base	120 mm
4	Diameter of Middle Shaft	65 mm
5	Height of the Middle Shaft	90 mm
6 & 7	Shape Block Size Length = Breadth = Height	40 mm
8	Attaching Rod Length	80 mm

**6.2 Dimensional Detailing**



**Figure 5: Dimensional Detailing**

**6.3 Instructional Drawing**



**Figure 6: Instructional Drawing**

#### 6.4 3D Modelling & Rendering



**Figure 7: Photo Realistic Render**



**Figure 8: Context Render**

### VII. CONCLUSIONS AND FUTURE WORK

#### 8.1 Conclusion

The Project address the current problems in musical toys present in the market and improves them utilizing various research methods. The main aim of the project is to develop musical toys for children to promote cognitive development. To develop the concept we must first understand the various aspects of the musical toys which includes the current types of musical toys present, their appearance, features, and materials used. After collecting these data's we get the consumers feedback on the current musical toy which the child plays. These help in providing information for brainstorm, mind mapping, exploratory sketches and finally with the concepts. The selected concept is visualized using various software's and material are assigned to obtain a realistic finish. Finally based on the feedback, additional suggestions can be taken to improve the current product.

#### 8.2 Future Work

This Project has a good scope in being implemented as it promotes cognitive development. This project also promotes the Make in India campaign. The toy helps in improving cognitive skill, motor skill and listening skills of the child which is critical. Early exposure of these lays foundation in generating other activates, which helps in the overall development of the child. Additionally, the current generation of children are overexposed to electronic devices at an early age which has an enormous impact in the development of the child.

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