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School of Engineering and Computer Science
BRAC University

Interactive Bengali Games using Multi-modal Communication for Autistic Children of Bangladesh

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DECLARATION

This is to certify that that this thesis report is submitted by the authors listed for the degree of Bachelor of Science in Computer Science and Engineering to the Department of Computer Science and Engineering under the School of Engineering and Computer Science, BRAC University. We hereby declare that this thesis is based on the results found by us and no other. Materials of work found by other researchers are mentioned by reference. This thesis, neither in whole nor in part, has been previously submitted for any degree.

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ABSTRACT

In developing countries like Bangladesh, autism is considered as mental disease and children are deprived from basic education and interactive learning opportunities. Studies have shown that using modern technology and gaming helps and encourages autistic children to communicate and develop in the society. This paper discuss the project of creating games targeting the autistic children of Bangladesh so that they can get learning experience that are interesting and entertaining. The games are made for universal platform (PC, android and MAC). There are multiple parts and each part motivates and acknowledges different aspects of autistic children. It includes colorful animation and motion to encourage children to express them in the society. The games are designed keeping in mind the Bengali alphabets, rhymes and children's discrepancy in learning or quick .This projects is done in Unity-game engine using C# and Java Script programming language.

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CHAPTER 1

INTRODUCTION

1.1 Autism

Autism is not a disease. We have thousands of autistic children in our country. Autism is a mental condition, present from early childhood, characterized by great difficulty in communicating and forming relationships with other people and in using language and abstract concepts. Autism appears to have its roots in very early brain development. However, the most obvious signs of autism and symptoms of autism tend to emerge between 2 and 3 years of age. There was a time when people with autism and other related disabilities were hidden from society by family members. But now through this awareness day lots of people properly know how to behave with them and what they should do for them. It is hard to communicate with them and teach them something. Autism affects girls and boys of all races and in all geographic regions and has a large impact on children, their families, communities and societies.

1.2 Motivation

In Bangladesh, we have lots of private and government NGOs to help the special children. But they are still not learning about lots of things as their process of learning is very slow. In Bangladesh, treatment and schooling for autistic children are expensive, which is a burden for a family that has to take care of other children and that is why every autistic children are not getting the proper education.

Special education is needed for autistic children. In this case playing games help them a lot. Other countries are applying it. Autistic children can see everything see everything in their own way and it helps in easy learning. Nowadays no one can breathe without technology. Autistic children of Bangladesh hardly know about all this technology. There are online based games which are made for them to help learning things. But the games they are playing are in English

so it is not so helpful for autistic children of Bangladesh. They do not understand what are the games about that's why they do not want to play it.

To overcome these complications, we have developed games in universal platform which will help the autistic children of Bangladesh to learn anything in an easier manner. Moreover, making games is an expensive process for the NGOs and schools as they are not able to gather the capital because of lack of funding. Even the largest gaming companies are also not willing to make any initiatives to make game for them as it is not commercially beneficial for them. So we decided to develop these games to contribute for the special children of Bangladesh.

1.3 Project outline

The project is about designing an educative and communicative game for the special children. We have made eight games in total where six are for educative and two are for communication. We have researched the behavior of the special children very critically and thus we have designed the games according to their choice and conveniences. The games are developed mainly to improve the skill related to the activities of daily living which children need to improve by using latest technology.

1.4 Project objective

The main objective of these educative and communicative games is to make the special children learn in an easier way and make them introduce to the latest technology. We have considered the scenario of our country; Bangladesh is a developing country but the special children are being neglected. The special children of other developed countries are getting more facilities specially in terms of education and in our country the schools are not able to provide those technological ways of education for the lacking of funds and that's why the children are lagging behind. On the other hand, Education is not being provided to them in such a way that they could learn something fast and easily. To make them learn something quickly games will be the best choice

as we can provide everything according to their preferences. After researching, we planned eight games where we could create a small world of learn and fun for them. We hope all these games

will boost up their mind sociologically as well. We try to give this small contribution to the special children and society. We also hope that the people of our society will appreciate the contribution and they will also try come forward for the special children.

1.5 Outline of this thesis

The thesis report is organized in such a way that the reader can understand the basic theories and the components of educative and communicative game. They will also be able to understand the detailed process and progress of how the progress went on. The report also describes the entire game plan of all the eight games in brief. The behavioral impact after implementing the games over the special children, the problem we faced and the limitations has also been discussed in the report. Finally the results and the discussion are being described in the end.

CHAPTER 2

HARDWARE REQUIRMENT ANALYSIS

2.1 Unity

Unity is a cross-platform game engine developed by Unity Technologies and used to develop video games for PC, consoles, mobile devices and websites. First announced only for OS X, at Apple's Worldwide Developers Conference in 2005, it has since been extended to target more than fifteen platforms. It is now the default software development kit for the Wii U. Unity Technologies made the complete engine available for free including all features, less source code and premium support. Unity is noted for an ability to target games to multiple platforms. Five versions of Unity have been released in 2006 at the 2006 WWDC trade show, Apple Inc. named Unity as the runner up for its Best Use of Mac OS X Graphics category. [10]

With an emphasis on portability, the engine targets the following APIs: Direct3D on Windows and Xbox 360; OpenGL on Mac and Windows; OpenGL ES on Android and IOS; and proprietary APIs on video game consoles. Unity allows specification of texture compression and resolution settings for each platform the game engine supports, and provides support for bump mapping, reflection mapping, parallax mapping, screen space ambient occlusion, dynamic shadows using shadow maps, render-to-texture and full-screen post-processing effects. Unity's graphics engine's platform diversity can provide a shader with multiple variants and a declarative fallback specification, allowing Unity to detect the best variant for the current video hardware and if none are compatible, fall back to an alternative shader that may sacrifice features for performance. [11]

There are many features absent in the free version of Unity. However, the most important differences are as follows: the free version of Unity lacks a number of rendering options that allow for better-looking, faster-running games. It also lacks the full mechanism animation system, and some AI tools. In general, for complex, large-scale projects, or projects where graphical performance is important, the pro version is worthwhile.

Unity addresses the issues faced by developers engaged in component-based software engineering. Unity is part of a growing trend in the technology industry, aimed at making it easier to create code. The company doesn't just let game developers make programs easier and faster. It also offers developers a way to produce apps for many different platforms without a lot of extra hassle. That's key since many mobile game makers are made up of small companies with just a handful of employees and limited resources.

There are so many game engine are available such as Big World, BlitzTech, CryEngine 3, Game Bryo, Shiva, Unity, Unreal Engine etc. Unreal Engine 4 (UE4) and Unity are arguably two of the most popular game engines available to the public today. While many game development studios use their own proprietary game engine there's still a huge market for indie developers and even larger studios needing a great game engine to help them creat their game. Both of them are notable for its ability to target games to multiple platforms (Windows, Android, Blackberry, MAC, IOS etc). Unity offers a completely free version ready for download. With Unreal Engine 4 there aren't free versions. Unreal Engine 4 uses C++ and Unity mostly C# or JavaScript. As we wanted to work in C# or JavaScript, we went for Unity. Unity is generally seen as the more intuitive and easier to grasp game engine. Our project was not quite large and for this type of project, Unity is the best option. Before starting with Unity we had to research a lot about all game engines and then we started working on Unity 4.5

Lots of popular games were made with Unity. Two of them are Cities: Skylines and War for the Over world. Some pictures ofthis two games are given below:



Fig 2.1 (a): pictures of “Cities: Skylines”



Fig 2.1 (b): pictures of “War for the Overworld”

2.2 Leap motion

The Leap Motion controller is a little USB fringe gadget which is intended to be set on a physical desktop, confronting upward. Utilizing two monochromatic IR cameras and three infrared LEDs, the gadget watches a generally hemispherical range, to a separation of around 1 meter (3.28084 feet). The LEDs create design less IR light and the cameras produce just about 300 edges for every second of reflected information, which is then sent through a USB link to the host PC, where it is investigated by the Leap Motion controller programming utilizing complex math as a part of a way that has not been uncovered by the organization, somehow comparing so as to incorporate 3D position information the 2D edges created by the two cameras. [12]

From a hardware perspective, the Leap Motion Controller is really very straightforward. The heart of the gadget comprises of two cameras and three infrared LEDs. These track infrared light with a wavelength of 850 nanometers, which is outside the unmistakable light range. For its wide point lenses; the gadget has an extensive communication space of eight cubic feet, which takes the state of a reversed pyramid – the crossing point of the binocular cameras' fields of perspective. The Leap Motion Controller's review extent is restricted to about 2 feet (60 cm) over the gadget. This reach is constrained by LED light spread through space, since it turns out to be much harder to deduce your hand's position in 3D past a certain separation. Driven light force is eventually constrained by the most extreme current that can be drawn over the USB association. [13]

Once the image data is streamed on computer, it's time for some heavy mathematical lifting. Despite popular misconceptions, the Leap Motion Controller doesn't generate a depth map – instead it applies advanced algorithms to the raw sensor data. The Leap Motion Service is the software on computer that processes the images. After compensating for background objects (such as heads) and ambient environmental lighting, the images are analyzed to reconstruct a 3D representation of what the device sees. Then the tracking layer matches the data to extract tracking information such as fingers and tools. Our tracking algorithms interpret the 3D data and infer the positions of occluded objects. Filtering techniques are applied to ensure smooth temporal coherence of the data. The Leap Motion Service then feeds the results – expressed as a series of frames, or snapshots, containing all of the tracking data – into a transport protocol. Through this protocol, the service communicates with the Leap Motion Control Panel, as well as native and web client libraries, through a local socket connection.

CHAPTER 3

GAME DEVELOPMENT PROCESS

At the very beginning we did research on Autism. We went to NGO called PROYASH which works for Autistic children. We have interacted with them to learn their behavior. We designed all the games according to their requirements. We gathered all the research experiences to develop our games for Autistic children using multi modal communication. We tested all the games several time. To complete our project we had to go through with some phases. The activities of the game development process shows below:

- Requirements analysis resulting in a games requirements specification
- Game design
- Development and Coding
- Testing
- Implementation
- Improvement

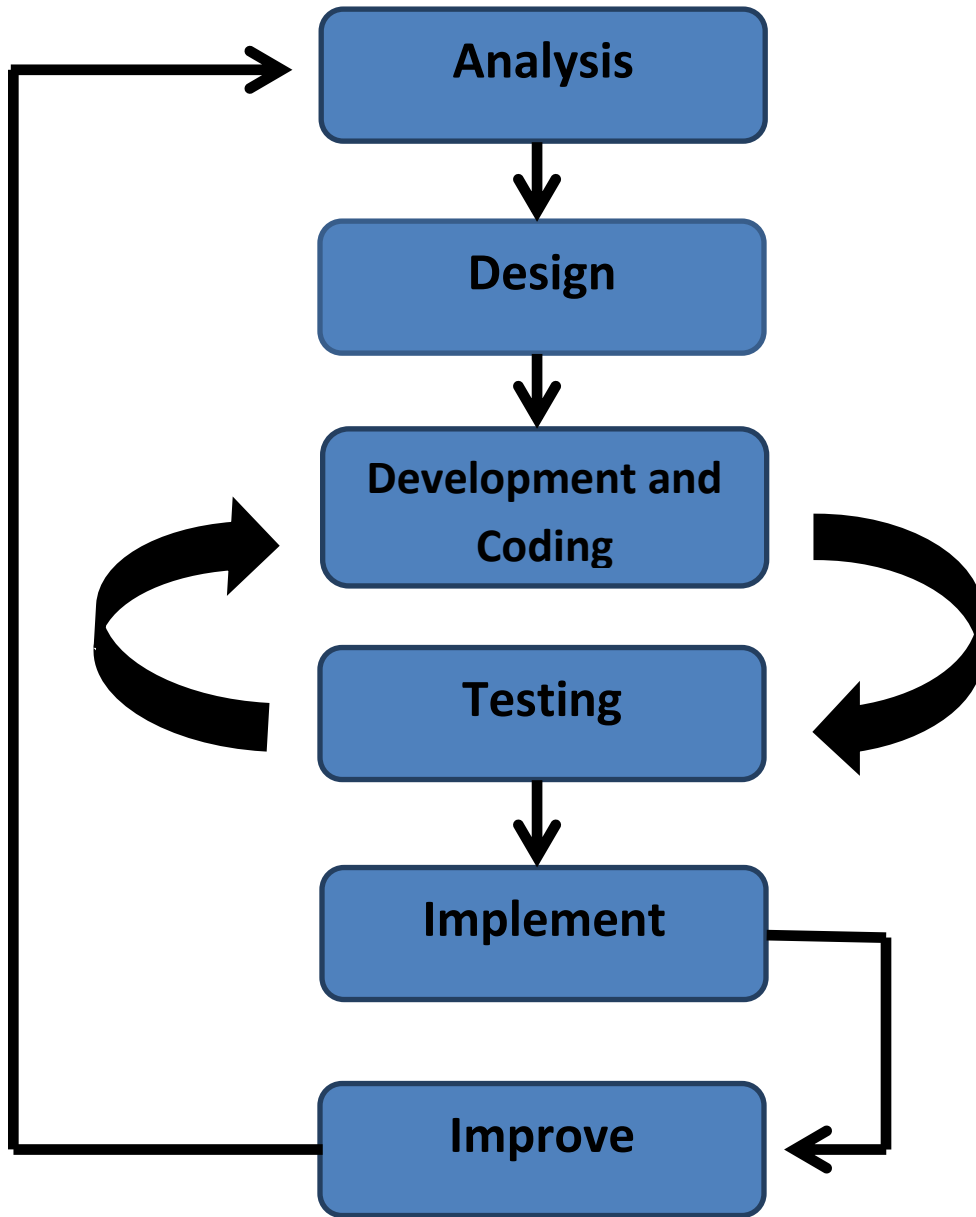


Fig 3: work plan for develop a game

3.1 Analysis

For about four months we have been visiting the organization PROYASH. PROYASH is an organization that works for autistic children. We went there to interact with the children and to understand their behavior, likes and dislikes. We monitor their daily activities and their need to make their daily life easier. We have read many articles on Autism and researched a lot. We have studied a lot about Autism. Autism is not the same for all children. There can be different types of Autism. Each type is different from another. So the requirements are not the same for all special children. Autism is one of the five pervasive developmental disorders (PDD), which are characterized by widespread abnormalities of social interactions and communication, and severely restricted interests and highly repetitive behavior. Some children have a problem with communication, some have verbal disabilities and some are mentally challenged. While visiting them we tried to monitor their daily life and daily needs. We tried to interact much with them so that we could realize the challenging points which they are facing. We use that knowledge to develop our games for special children so that they can have an easier life.

3.2 Game design

We develop all the games according to our research and the requirements. As we talked and interacted with them we have learned about their daily needs. We found some children are not interested in studying with books but they like music and rhymes. Some children have a problem with concentration and eye contact. Some children have a communication problem. They cannot communicate with others that's why no one can understand their needs. The most important thing is most of them have an interest in computers and smartphones. We talked with some parents they said their children are very much interested in computer games and other devices. That is why we wanted to develop games which would be helpful to make their life easier. Initially we had planned for six games. But later we added two more games. So we have developed eight games for the children. By interacting with the children we came to know they don't like boring stuffs.

So we tried to make the games interesting. For making the games interesting we have added animated cartoon characters and engaging background music. In our country we don't have any

games for Autistic children. So we made all the games in Bengali language with Bengali subtitle.

Our first game is “Magic Coins”. With the assistance of this game, they turned out to be extremely intrigued about knowing the letters in order. Normally they used to know letter sets through either perusing books or listening to rhythms from the instructors and parents. Through this game they came to see some intriguing things with the alphabets by the latest technology.

The second game is called “Ride in Aero plane”. In this game we have used Leap Motion which is taking the gesture of hands as input. There is plane which will move according to the movements of hands. This game is made for helping them to enhance their hand development and eye contact.

The third one is called “World of Colors”. By playing this game they came to know about heaps of color. They used to think about just in the range of few color. They used to hear just the name of the color, yet through this game they can see the example. They played it with enthusiasm as they found themselves able to see and hear everything about what they are realizing.

This fourth game is called “Body parts rhymes”. It is a game with rhymes. In this game, there is an animated character which helping them to teach about body part with some rhymes. By playing this game children came to learn the body parts and different rhymes.

The fifth game is called “Let’s play with DoreamonandMario”. By playing this game they came to know about the directions.

The sixth game is called name “Let’s play with Mili”. In this game they came to learn about so many colors in a different way. There is animated cartoon character Milicomes every time with different things and ask question about the objects color. The children play this game with amusement.

The seventh game which is number eight is called “Let’s know about body parts with Opu”. This game has significant effect on the children. It helped them to increase concentration. By doing so, we notice significant changes on flexibility of movement.

The eighth game is called “Wish Book”. This game is made for helping them to communicate with people. The children who cannot talk properly, they liked this game most as it helped them to express what they wanted to say to others.

However at the time of monitoring we found some games are difficult for them to play. Then we had to design that game again to make easier. Our motive was to encourage them, entertain them and teach them in easier way. So we did not plan for anything that they cannot play. We tried to appreciate them even when they gave wrong answer.

3.3 Development and Coding

We have developed all the games in Unity game engine. Unity is a cross-platform game engine developed by Unity Technologies and used to develop video games for PC, consoles, mobile devices and websites. We have made the games for all platforms so that everyone can use these easily. The programming languages we have used are C# and Java Script. We have used several coding for animation and other stuffs. We have so many animated cartoon characters in our games .We have to made individual cartoon character for every level of each game. So we need to animate the character and for that we use several codes. We use different codes for movement of different body parts of character. For example in the body parts knowing game, we need to animate hands, legs, eyes etc. and we have used several codes for this. Every game has different level. In each level we had to add code to change the current level. All the background and graphics work we did in Unity game engine. For background animation we use several codes. Some children cannot hear and for those children we have added sub title of audio. The subtitle we have added has added as button. We designed all the buttons with the help of NGUI. As all the games are made for the special children of Bangladesh so we had to make all the buttons in Bengali language. Each game contains different background. Every subtitle has audio with this. Every rhymes has made by us in Bengali language. First of all we recorded audio then had to convert to Unity excepted format. Then we included those with our games.

3.4. Testing

After finishing the games we have tested several times. We have tested by us and by the other normal children to find out if there is any bug or not. If there is any, we have developed that part once again. Then we rechecked the code and again we tested. Each time the requirements change so we had to rewrite the codes several times and had to redesign. When we made the final version we checked it several times. We gave those to normal children to test that whether they are able to play or not. Because we know that the mental growth of normal children and special children is not the same. We made the games for those children who are at the age of 8-10. And finally we gave the final version of our games to PROYASH to check whether they are able to play or not. Some games were found hard for them. So we had to redesign those because we do not want to develop those games which are difficult to play for them rather we want to motivate them to do something. We want to encourage them to learn.

3.5 Implementation

We gave all the games to “PROYASH”. We went there and have installed the games to their labs. Surprisingly they have liked our games much. They were very interested to play the games. Our target children are those who are at the age of 8-10. We took 4 or 5 children from each class. Every day the teachers of PROYASH took them to the lab to play the games. Every week we went there to monitor the improvement. The teachers of “PROYASH” helped those children who were not able to play the games by themselves. And we went there twice a week. We went to another school for autistic children called “AMOR JOTY” to implement our games. At this school we selected 20 students at the age of 7-10. We gave them our games as well. The environment of that school was very friendly so that we could be able to collect data.

3.6 Improvement

To monitor the improvement we went to PROYSH twice a week. We have tested for four months. Surprisingly in this four month they have improved a lot. We made chart for every games to monitor the improvement within one week. Every week we measured the improvement. At the very beginning they did not have much interest on the games but now they liked the games. The teachers said to us the games are very effective. All the games are very helpful to teach them different things. One of teacher named Mdm Mostafa Amir Faisal, PROYASH especially mentioned about our game called “Magic coin”. Students were not interested to learn the alphabets but now they know the alphabets by playing that game.

CHAPTER 4

GAME DEVELOPMENT

4.1 Game I: Magic Coins (about knowing Bengali alphabets)

4.1.1 Purpose of Making “Magic Coins”

In this game player has to collect all the coins with a ball and each coin correspond to a Bengali alphabet. The main reason of this game is to teach the autistic children about Bengali alphabet. Kids suffering from ASD are hard to handle and teach. They suffer from dyslexia. Often parents and teachers need to give extra attention and repeat each item several times before they can adopt it. It is hardly possible to do most of the time due to time constrain and requires a lot of patience. Though there are special schools in Bangladesh, many families are unable to admit their children in them and some are ignorant enough to do so. Since ASD children has less coping ability than other normal child they are often ignored in classroom. Even in special schools, as no autistic child is same and they all have different learning curve, teachers need to tend to each student individually and repeat as many time as needed. Realistically, this rarely happens here and school teachers leave that part of repeating to their parents as ‘homework’. At home, generally along with all other non-ASD brothers and sisters parents fail to take care of that ‘homework’ for that special child from their busy everyday chores. As a result the child lacks education and becomes dependent for rest of their life. [5]

However this little game can help to change that. This game does not require parents’ or teachers’ guidance to play along. The child can use this as many time as they want to learn the alphabet. It not only covers the repetition of each alphabet but also make sure to keep the children’s concentration. ASD syndrome often comes with concentration deficiency. Children often get distracted and easily loss interest on what they are doing. This game was created in a way that attracts children with color and challenges. After completing the game they are also

Appreciated and invited to play again which encourage them to keep playing because their efforts are most of the time left unappreciated.

While making the game for autistic child some research had been done to see what are available for autistic children already. It had been found out that all the educational games are in English which, though international language doesn't help interact with Bangladeshi ASD children. Since birth they are familiar and comfortable with Bengali language. According to defense language institute (DLI) Bengali is in the category two of the hardest level out of 4 levels. As the child is born and growing up in Bangladesh, he will be able to understand the instruction better if it is presented to him in his familiar language. This game fulfills the purpose of teaching children Bengali alphabets as well as interacts with them in Bengali instructions.

The game also has some colorful visuals. According to the International Society for Autism Research (INSAR), autistic children thought to be get active if there is colorful visuals and musicals. They can remember when presenting with pictures and colors. This game has the colorful background with frogs, elephants and flowers which will encourage them to play more times and learn.

The difficulty level of the game is also designed keeping in mind of their ability. According to Dr. Erin Moran from Portland Autism Centre autistic children are concrete thinkers. Their intelligence level varies from children to children. The obstacles in the game are to build up their ability to face challenges and finish what they have started. It is often seen that as they soon lose their interest, they tend to keep things unfinished. This game is purposed to intrigue them to finish and collect all coins.

4.1.2 Game Plan

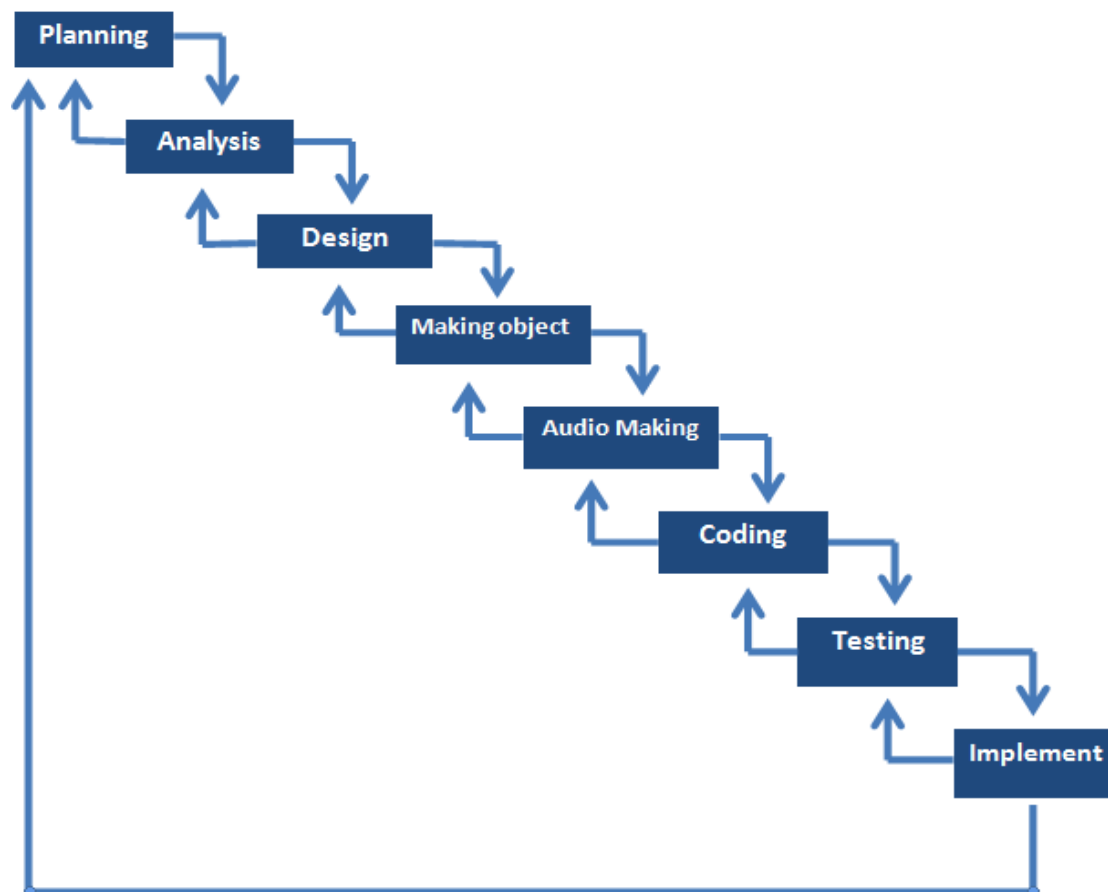


Fig4.1.2:game Plan of “Magic Coins”

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASHover and again just to analysis the behavior of the children’s critically.We try to observe the behavior of the children to get the information that in which way we can make the game so that it will be both easier and user friendly for them. Easier manner will make the game playful for them and they will play it more often. So initially by going there we get the ideas of the patterns of the games. Analyzing their behavior actually is the most important part of the planning because we are able to know about their likings disliking and what interest them most. We came to know that they love the usage of

Colors and cartoon characters are very much familiar to them so putting these things on the game will make the game more interesting. Analyzing their behavior is the most important part of the planning because we were able to know that there are different types of autistic children and most of them are able to listen and talk so a game with audio rhymes and poems for all the Bengali alphabets will make them interested to learn and play the game. The rhymes will be in Bengali so they won't be facing any kind of difficulties rather it will make them memorize all the rhymes and poems. After that we started to focus on making the audios and we think of some small poems will appear with all the alphabets that will make them learn both the alphabets and the poems. So selecting some of the popular poems for each of the alphabets and making the audio was the second part of the planning. Then we estimated the most probable time of making the game prepared because a lot of work has to be done like finding the suitable poems, resemble them to the alphabets and make the game a bit interesting with background for them so that they want to play the game more often. Then we estimated the time that the children will take to learn the poems and alphabets because for them it is not very easy to learn by over and over. We eventually decided to make them play the game for sixteen weeks and that would be enough for them to learn those poems and alphabets. Further we decided how many children can we have to play this game and we took over ten children to play the games for sixteen weeks. We decided to take only ten children because we wanted to see the real outcomes that how much this helps to learn by this particular game.

Analyzing was a very important part for making this game. Because by this, we get to know how we can make our games that will make them learn. The way they are learning in PROYASH is the main key point as they are learning in a pattern and by using the same pattern in our game will make them learn those things easily. We have analysis that they teach their students alphabets by using different types of rhymes. They do it in a day for couple of times and it is actually not enough for them to learn. So in the game we used all the same rhymes and poems that are used by PROYASH as it will be familiar to them and they could play it whenever they want that will make them learn a bit faster. PROYASH uses all the Bengali small poems in their school that are very much popular among the children. We also analyzed that they love to visualize. For example, when they are listening to a rhyme if there are some pictures of it or some other video

Or moving objects they feel very excited with it and its help them to memorizes that thing and learn easily. So we actually analyzed all the behavior of them so that we get to know about how we can make the game interesting for them so that they play and learn. We analyzed their likings disliking and the terms and patterns of what makes them happy, what makes them learn and what makes them interested to make the game more joyful for them.

This game has properly been designed for the autistic children so that they can be able to play it without any kind of difficulties. This special kind of children loves to visualize the thing that they are listening that is why this game has different ups and downs with the alphabets along with the audio poems and rhymes. This game has been developed in an easy and effective manner for them as per they like with the backgrounds and options. We have designed the game in a way that, with the appearances of all the alphabets at the background there is a constant cartoon character and this cartoon make the game joyful for them. They also want to discover that after the following alphabet whichAlphabet and rhymes are coming and all that resulting in enable them to play the game again and again. We have specially designed this cartoon for the background so that it interests them and make them familiar to the game. We have used lots of variations of colors in the game and made the game colorful enough to interest them. Colorful things make them think in an easier way and even if they are not able to play properly it holds the concentration of them. We have structured the voice of the poems and rhymes by a child so that it catches the attention of them. These kinds of children are much more comfortable with other children rather than younger people that's why when they hear the voice of the poems they listen to it properly and try to imitate what she/he is saying resulting in learning the poems and alphabets. Besides, Colors and the cartoonhold the concentration of them to look into the screen for a longer period of time.This game has been designed in a very user friendly way focusing only on the autistics children. A very few obstacles and stages has been made only to make them interested to play the game. The starting and exiting options of the game along with the playing method everything are very much user friendly for them. No children will be facing difficulties while playing the game because there are only three terms to get the alphabets and poems and they are left, right and jump.

We had to make objects and audio for the game. We had made colorful game objects for the children to attract to play the game. We had to make different game objects for coins, ladders, obstacles and ball. In the entire game we have used 12 audios. For audios, we have recorded the voice of eight years old child. We had to put code to make the ball jump from one ladders to another, fix the ball's physics and to make the coin vanish when the ball will collect it. In game details (4.1.3) we discussed about it in details.

Testing is most important after the game has been designed. After the game has been properly made we our-self played the game couple of times before giving them to play. We ensured the easiness of the game over and over so that they won't face any difficulties. After much of assurance we made the game play by other normal children. This was actually the part of our testing program to see how the normal children play our games and what their feedbacks were. We saw that all the children were able to play the game properly with no difficulties and to many of them it was easy and fun as well some of them were able to recall the alphabets and poems. Then we were assured that this game could be played by them and it will help them in their learning process. Then finally we give them the game to play and their responses were remarkable. They were very happy to see the colorful theme and background cartoon with the moving object. Many of children listened to the small poems with concentrations. They were able to finish the entire game. We had implemented the game on 10 children for months and the result was outstanding with a great progress rate over the weeksand thus the children were able to learn alphabets through poems and rhymes. When we are done with the testing then we implemented the game on the special children.

4.1.3 Game Details

The first game is called "Magic Coins". In this game there are 22 leaders with colorful 11 coins, 11 colorful obstacles, 11 alphabets and a ball. The ball will go forward and it will jump with space button. In the background of every coin there will be an alphabet. When the ball collects the coin, we will be able to hear a small rhyme with the corresponding alphabet. We gave obstacles to make this game more interesting. There is simple musical background this game.

After collecting every coin there will be colorful particles to make the children for interested to play the game. When the children will reach to the last coin, they will hear a congratulating voice with particles.

As it was our first game, we had to struggle a bit with it. We had to learn everything that Unity Game Engine has. We had to watch almost 50 tutorials before making this game.

We made a game starting page for it. We started with a new scene. We had to make a background for it at the first place. We had to import the texture of the background in Unity Game Engine. We can give any texture to the obstacle. We chose a flower based texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. We put 20 in X axes, 15 in Y axes, 1 in Z axes. Then we put the name of the games in Bengali. We had to make it in Bengali. Then we imported it into Unity and save the texture as we saved the background. Then we had to resize it. We had to make it smaller than the background. We put 5 in X axes, 1 in Y axes, 0.1 in Z axes. Then we had to make buttons. We imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. It was the difficult part as NGUI has its own camera and it makes everything messed up. The button was being lost. Sometimes it was covering the whole scene. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. Then we put a code in C# to go the next level. We named it level02. If anyone does not want to start the game den the person can escape, then it will be exited. It is being added by code. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it.

We took new scene and named it level01. For making the first the ladder, we had to import the texture of the ladder in Unity Game Engine. We can give any texture to the ladder. We chose a

wooden texture for the ladders. Then we made a quad component for the ladders. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the ladder. As there are 22 ladders and in each ladder there will be ball, obstacles and coins. So we had to make the size very carefully. So the ball doesn't fall often from the ladder and it can hold other things as well. We put 20 in X axes, 1 in Y axes, 2 in Z axes. In the same way we made all other ladders. For each ladder, we had to make different component and materials. As we gave same texture to all ladders, so we did not had to import texture for it. we had to fix the position of all the ladders. We did not keep all the ladders in the same level as we wanted to make the ball jump from one ladder to another. We faced problem while fixing it as one ladder was clashing with another. We had to zoom out to see the whole game project as there were 22 ladders in scene. But we could not see the actual position of the ladders for zooming it. We had to change it several times.

For making the first coin, we had to import the texture of the coins in Unity Game Engine. We can give any texture to the coin. We chose orange texture for the coins. Then we made a sphere component for the coins. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the coin. The coin should not cover the alphabet and the background. So we had put 0.3 in X axes, 1.5 in Y axes and 1 in Z axes. The coin was planned to be in the ladder so that ball can collect it. But we wanted to rotate it until is being collected by the ball. So we kept in the upper side of ladder unless the coin will not be able to rotate. In the same way we made all other coins and put it on the odd even number of ladders. For each coin, we had to make different component and materials. As we gave different texture for coins, so we had to import 11 textures, make 11 materials and 11 components for it. We had to fix the position of all the coins. We did not keep all the ladders in the same level as we wanted to make the ball jump from one ladder to another, so the position of each coin was different for each ladder. We faced problem while fixing it as coins was clashing with ladders. We made colorful particles according to the color of the coins. Then we saved the particles into the coins. In the coin we had to do lots for things by coding which is done in java script. We had fix by coding the

Rotation speed of the coin, how the coin will be vanished whenever the ball will collect it and how there will be particles after collecting the coins.

For making the ball, we had to import the texture of the ball in Unity Game Engine. We can give any texture to the ball. We chose green texture for the ball. Then we made a sphere component for the ball. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the ball. Before resize the ball, we had to keep lots of things in our mind. The ball should not cover the background, the alphabets, it should be able to collect the coins and cross the obstacles by jumping. So we had put 1.5 in X axes, 1.5 in Y axes and 1 in Z axes. For the ball we had to put lots of physics. The ball was going under the ladders. We had to put the physics so that it can be settled upon the ladder. All the codes for ball is done in java script. By coding we had to fix the falling range of the ball. Whenever the ball falls from the ladder, the game starts again from the beginning. We had to do it by coding. The ball keeps rotating and we had done it with code. The ball was clashing with the coin while collecting it. We had to fix it with code.

For making 1st alphabets, we had to make the texture of the alphabets along with some colorful cartoons to attract the children. Then we had to import the texture of the alphabet in Unity Game Engine. We can give any texture to the alphabet. We chose the first alphabet texture for the first alphabet. Then we made a quad component for the alphabet. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the alphabet. Before resize the alphabet, we had to keep lots of things in our mind. The alphabet should not cover the background; it should be larger than the ball, coins and obstacles. So we had put 8 in X axes, 7.5 in Y axes and 1 in Z axes so the children see it properly. In the same way we made all other alphabets and put it in behind of odd even number of ladders. For each alphabet, we had to make different component and materials. As we gave different texture for each alphabet, so we had to import 11 textures, make 11 materials and 11 components for it. Then we had to fix the position of the alphabets. We had put the alphabets behind the ladders so that it can be visible. As all the ladders are not in the same position, so positions of all the alphabets were not same. We had to fix manually.

For making 1st obstacle, we had to import the texture of the obstacle in Unity Game Engine. We can give any texture to the obstacle. We chose the pink texture for the first obstacle. Then we made a quad component for the obstacle. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the obstacle. Before resize the obstacle, we had to keep lots of things in our mind. The obstacle should not cover the background; it should be in the ladder. So we had put 1 in X axes, 1 in Y axes and 1 in Z axes so the children see it properly. In the same way we made all other obstacle and put it on the even number of ladders. For each obstacle, we had to make different component and materials. As we gave different texture for each obstacle, so we had to import 11 textures, make 11 materials and 11 component for it. we used different shapes of obstacles here as quad, capsule to make it more interesting. Then we had to fix the position of the obstacles. We had put the obstacle upon the ladders so that it can be visible. As all the ladders are not in the same position, so positions of all the obstacle alphabets were not same. We had to fix manually.

Then we had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose a cartoon based texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 33 in X axes, 35 in Y axes and 7 in Z axes so the children see it properly. We made another camera. We had put it into under that camera. In the background we put a code in C# where the background will go along the ball. So for the entire game, the background will be same.

We had to make audio for each rhymes. We recorded voice of a 8 year old girl for this game. Then we imported it to Unity Game Engine. We put the rhymes into the coins. Each coin has different rhymes. The rhymes were being played by code whenever the coin was collected. We had added soft background music for it. after importing the audio, we had to make an empty game object for it and then put the audio into the game object.

After the last alphabet we put coin in another in the ladder to congratulate them for playing successfully. After collecting the coin, they children will be able to see the fireworks. We put a code under the main camera of Unity Game Engine in java script to follow the ball. We made a button so that anyone can end whenever they want to end it. For that, we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. . We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. We put a code in C# into the button; whenever the button is being pressed the game ends.

4.1.4 Benefits of Playing“Magic Coin”

During the game children has to use their keyboard to move forward or backward to collect the coins. Once they collect each coin they will hear about a Bengali alphabet and corresponding words that could be made from that alphabet. Also they will listen a rhymes made with that word in rhymes. From this process they are going to be benefitted in following ways.

The children are getting to learn the Bengali alphabet easily and as long as it takes them to learn. They often fail to remember alphabets because there is no one to repeat them each and every time they want to hear it. Each letter is introduced with a word and a rhyme which gives them first introduction to a new object. They will be able to know what object or word can be made out of that alphabet. It will trigger their curiosity to know more about that word and help them develop their vocabulary. They will also hear the rhymes which will keep their concentration towards the learning process. As it is seen several time that small rhymes attracts not only ASD children but also any other school aged children. It will help them to remember what they learned during the game.

During the game children have to make the ball move forward, collect coins and jump to overcome obstacles. These action might seem easily for a normal 10 year old children however, it is difficult for them to all those properly as their brain doesn't function quickly. So this gamehelps them to practice that fluidity of task management to overcome obstacles and get to

the next coin. “Kids with autism are very concrete and literal thinkers,” says Dr. Erin Moran, psychologist with the Portland Autism Center. They get to learn that getting a coin is giving them knowledge about a letter. So in order to achieve something in this case to listen they have to earn something.

The background pictures and colors trigger their cognitive mind and help them to improve their concentration. It is often possible to concentrate towards the frog or the monkey at the back as that seems more appealing to them. However in that case they soon understand that the ball is their main object and they learn to concentrate on that. Also they figure that if they forget about the ball or move wrong way it might fall from the wood piece and that will be game over. During this game they will learn to get their priorities straight.

Some pictures of this game are given below:



Fig 4.1.4 (a): picture of “Magic Coins”



Fig 4.1.4 (b): picture of “Magic Coins”



Fig 4.1.4 (c): picture of “Magic Coins”



Fig 4.1.4 (d):picture of “Magic Coins”

4.2 Game II: Ride in Aeroplane

4.2.1 Purpose of Making “Ride in Aeroplane”

Since 1960s infant researcher has found that children motor skills that include reaching, crawling, grasping object with hands or walking help them learn basic social and communicative behaviors. Children with ASD have different types of motor disorder like head lag, floppy arms or moving things. These motor difficulties or in other word sensory integration issues makes it difficult for them to focus their eyes in an object. It also causes problem getting information from their brain to move their hand accordingly. These symptoms are seen at the beginning of the infant stage and with proper practices these laggings can be fixed.

It required much practice to make proper movements of hands and legs. Sometimes there is difficulty coordinating two body parts. For example, seeing nice scenery and clapping for it is general output. Here the eye and the hand co-ordinates and because of what eye appreciates hand responds to that. Autistic children faces trouble processing information and coordinating five senses according to their emotions. They want to express their mind with movements and fail to achieve that goal. This makes them irrational and they get hyped up for unable to expressing their emotions. Most of the psychological journal mentioned about how autistic children get stress out and hyper active due to deficiency of expressing themselves.

This game is designed to help them move their hands and eyes. Leap Motion means the game hardware sensor needs hand and finger motions as input analogues to a mouse or keyboard though it does not require hand contact to the screen. It has been used in this game to move an aeroplane forward, backward, upward and downward. The challenges in the game force them to co-ordinate their actions and express them through movements over and over again until they are comfortable.

It is also seen that autistic children avoid eye contacts in social interaction and often they fear looking at moving large objects like aeroplane, birds or car. Sometimes they can't cope up their eye contact with moving object as they have to move their retina along the object. Furthermore, the moving object they are following doesn't always move to the predicted way, which gives the child more difficulty to catch up with it. The game is designed to help the practice the eye

contact and following the motions with their eyes. Moreover, it is seen that autistic children reject social and physical contact. That means not only people but also they avoid touching unknown objects. So, this game Leap Motion is purposed for that specific behavior of the children.

Another purpose of this game is to teach the children about the direction and space. The full game is on the air. They will see objects that can only be seen in the sky. Also due to their sensory integration disorder they have problem copying or imitating. Imitation is a common response from any normal infant. It helps develop their social behavior and teach the common social courtesy. However autistic children lacks imitation which also result damaging peer play, language outcome and play skill, it also hinders sharing focus with another person or object. This Leap Motion is designed such a way so that they could overcome these difficult trends.

4.2.2 Game Plan

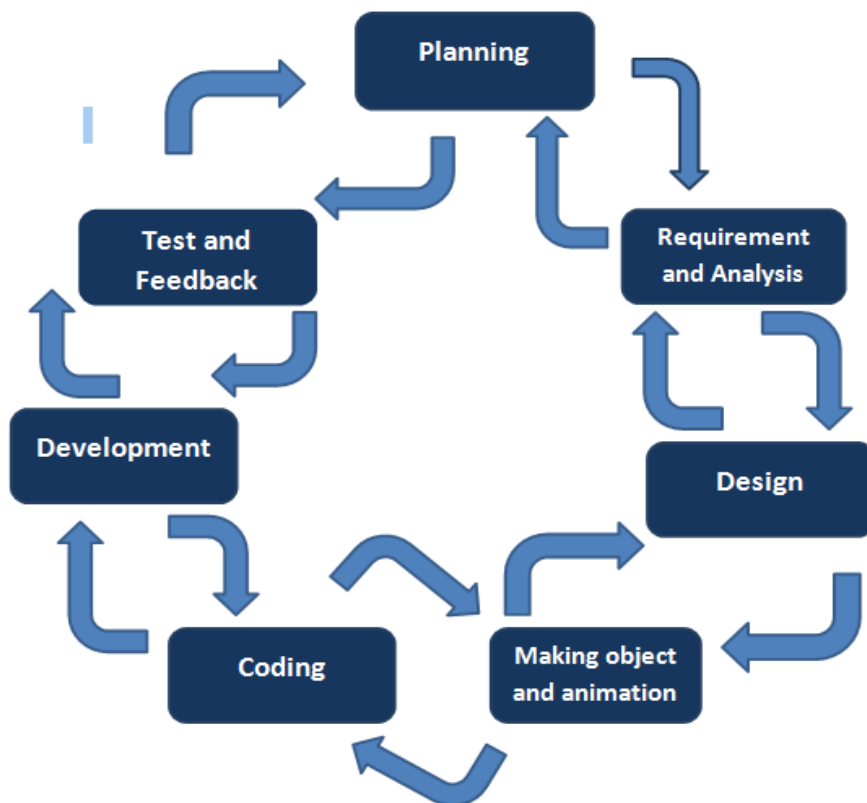


Fig 4.2.2: game Plan of “Ride in Aeroplane”

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASHover and again just to analysis the behavior of the children'scritically. Wetry to observe the behavior of the children to get the information that in which way we can make the game so that it will be both easier and user friendly for them. Easier manner will make the game playful for them and they will play it more often. So initially by going there we get the ideas of the patterns of the games. Analyzing their behavior actually is the most important part of the planning because we are able to know about their likings disliking and what interest them most. Also we take into consideration the matter of what types of game can make them better physically. If we can make them doing some kind of exercise in disguise of a game that would have highly beneficial for them. We came to know that they loves the usage of colors and some lively things make their concentration better so putting this things on the game will make the game more interesting. Analyzing their behavior is the most important part of the planning because we were able to know that there are different types of autistics children and some of them have issues with their hand gestures and movements. So we planned of making a game that will make them do hand exercise side by side they can play the game. Then we planed of making the background very lively for them so that it gave them a glimpse of the sky. In the background we planned of giving sky and clouds and as object we planned of giving an aero plane as these things make them interested to play the game frequently. We planned of making everything just like they are riding a plane in the sky which will hold the interest of them. As with the help of the Leap Motiondevice they hold the control of the plane so it motivates them to play the game again and again. Then we estimated the most probable time of making the game prepared because a lot of work has to be done like making a bit interesting background with the sky, clouds, kites and other objects .It is the challenging part because the game has to be eye-catchy and attractive for them. Then we estimated the time that the children will take to properly play this game because for some of them it is not very easy move their hands and do eye contact with the screen. We eventually decided to make them play the game for sixteen weeks and that would be enough for them to be able to play this game. Further we decided how many children can we have to play this game and we took over ten children to play the games for sixteen week. We decided to take only tenchildren because we wanted to see the real outcomes that how much this helps to learn by this particular game.

Requirement and analyzing was a very important part for making this game. Because by this, we get to know how we can make our games that will help them about their physical imbalance. We have observed in PROYASH that many of the children are unable to straighten their hands but they try to do something with the computers and smart phones. So we analysed that if some kind of game with computers can be made to develop their movements that will be great. We also analyzed that they love to visualize. For example, if the background is very lively and full of colors that will make them play the game twice and more. So putting those objects and making the game lively would help them to remember the objects as well resulting in daily exercise. So we actually analyzed all the behavior of them so that we get to know about how we can make the game interesting for them so that they play and learn. We analyzed their likings disliking and the terms and patterns of what makes them happy, what makes them learn and what makes them interested to make the game more joyful for them.

This game has properly been designed for the autistic children so that they can be able to play it without any kind of difficulties. This special kind of children loves to visualize that is why we have designed the game with lots colorful background objects and a playful plane. This game has been developed in an easy and effective manner for them as per they like with the backgrounds and options. We have designed the game in a way that, with the appearances of all the objects and plane the children will be tempted to play the game. The animation has been highly designed so that it makes them feel they are in the sky riding a plane. They want to discover what they can do with the planes all that resulting in enable them to play the game again and again. We have specially designed the background so that it interests them and make them familiar to the game. We have used lots of variations of colors in the game and made the game colorful enough to interest them. Colorful things and movable objects make them think in an easier way and even if they are not able to play properly it holds the concentration of them. We have structured a background sound while riding the plane because it keeps them sick to play the game and make them realize they are still playing the game. This game has been designed in a very user friendly way focusing only on the autistics children. The starting and exiting options of the game along with the playing method everything are very much user friendly for them. No children will be facing difficulties while playing the game rather they feel more interesting to play the game frequently as they can ride the plane by themselves.

We had to make objects for the game. We had made colorful game objects for the children. We animated the game object to attract them. We had to put code to take input from Leap Motion and connect it with Unity Game Engine. Then we made the entire game in development part.

Testing and Feedback is most important after the game has been designed. After the game has been properly made we our-self played the game couple of times before giving them to play. We ensured the easiness of the game over and over so that they won't face any difficulties. After much of assurance we made the game play by other normal children. This was actually the part of our testing program to see how the normal children play our games and what their feedbacks were. Then we were assured that this game could be played by them. Then finally we give them the game to play and their responses were remarkable. They were very happy to see the colorful theme and background cartoon with the moving object. We had implemented the game on 10 children for months and the result was outstanding with a great progress rate over the weeks. When we are done with the testing then we implemented the game on the special children.

4.2.3 Game Details

We made a game starting page for it. We started with a new scene. We had to make a background for it at the first place. We had to import the texture of the background in Unity Game Engine. We can give any texture to the obstacle. We chose cartoon based texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. We put 36 in X axes, 23 in Y axes, 1 in Z axes. Then we put the name of the games in Bengali. We had to make it in Bengali. Then we imported it into Unity and save the texture as we saved the background. Then we had to resize it. We had to make it smaller than the background. We put 5 in X axes, 1 in Y axes, 0.1 in Z axes. Then we had to make buttons. We imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. It

was the difficult part as NGUI has its own camera and it makes everything messed up. The button was being lost. Sometimes it was covering the whole scene. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. Then we put a code in C# to go the next level. We named it level02. If anyone does not want to start the game den the person can escape, then it will be exited. It is being added by code. We added soft music in it. for that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty component and then save the audio into it.

We took new scene and named it level01. For making the main component which is an aeroplane, we had to import the texture of the aeroplane in Unity Game Engine. We can give any texture to the aeroplane. Then we made a quad component for the ladders. We had to make a new material where we saved the texture that we want to give and then put the martial to in the component. By doing it, we got our desired texture. Then we had to resize the ladder. We put 2 in X axes, 1 in Y axes, 1 in Z axes.

For making another component which is a sun, we had to import the texture of the sun in Unity Game Engine. We can give any texture to the sun. Then we made a quad component for the ladders. We had to make a new material where we saved the texture that we want to give and then put the martial to in the component. By doing it, we got our desired texture. Then we had to resize the sun. We put 2 in X axes, 1 in Y axes, 1 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

For making two birds, we had to import the texture of the birds in Unity Game Engine. We can give any texture to the birds. Then we made two quad components for the birds in different sides. We had to make two new materials where we saved the texture that we want to give and then put the martial to in the component. By doing it, we got our desired texture. Then we had to resize the birds. We put 0.5 in X axes, 0.5 in Y axes and 0.5 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide

how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

For making two clouds, we had to import the texture of the clouds in Unity Game Engine. We can give any texture to the clouds. Then we made two quad components for the cloud. We had to make a two material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the clouds. We put 2 in X axes, 1 in Y axes, 1 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

For making another component which is a kite, we had to import the texture of the kite in Unity Game Engine. We can give any texture to the kite. Then we made a quad component for the kite. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the kite. We put 15 in X axes, 15 in Y axes, 1 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

Then we had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose sky texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 25 in X axes, 10 in Y axes and 8 in Z axes so the children see it properly. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide how much long we want the component

to be animated. After creating the animation, we had to put the animation into the component. The background goes left to right and then again right to left. This will make the children feel that they are moving the aeroplane with their hand movement. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it.

We made a button so that anyone can end whenever they want to end it. For that, we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button.. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. We put a code in C# into the button; whenever the button is being pressed the game ends.

The part of this game was connecting the Leap Motion sensor with Unity Game Engine. We had to read lots of paper for it. To connect the leap motion with Unity Game Engine, we need to import the Leap motion package. After connecting the Leap Motion, we need to add to the component. We were not familiar with writing code in Unity with Leap Motion. We had to count it on axis for moving the component left-right, up-down and forward-backward. We put the code on the aeroplane to make it our main component.

4.2.4: Benefit of Playing “Ride in Aeroplane”

The game is to ride an aeroplane in the sky by moving the hands in the direction of choice and avoid any obstacles in front of the plane. Children have to move the aeroplane with their hands. This gives them the opportunity to practice hand moving skills. To take the plane forward they have to move their hand to left and to prevent the obstacles they have to move upwards or downwards to avoid collisions. Due to sensory integration issues information incorrectly processed by brain which cause discomfort and confusion. This game will help them practice their motor disorder. It will teach them to process the plane moving information in the brain and

command the hand to move in suitable and safe direction. They get to understand the difference between left-right and up-down.

They also understand that hitting an object makes a collision and thus accident occurs. So they have to watch out for object that might cause accident and react when the object appears. They master the coordination of eye and hand movements. When the obstacles approaches they see it with their eyes and try to save their.

Another beneficial fact of this game is that their brain will practice processing information from their optical sense. They will be able to overcome underlying problems that comes with sensory processing difficulties including avoiding eye contacts and stemming behavior. They will be able to deal with ophthalmological and perceptual processing disorder.

They also get to know about new objects that they could find in sky. The kites, clouds, sun and birds are the usual object one could see in the sky. Since they lack common sense and require repetition, seeing only these stuff in the sky all the time during the play make them understand that these objects belong to the sky. Gradually this build up their common sense and curiosity to find out what else could they find in sky. They will get to know that certain things belong to certain places and become more cautious where they are putting an object of their own.

This game allow them interact in a way as if they don't have a disability. By playing this game they more productive and excited as it is a new type of technology to them. During the game they have to keep long eye contacts with the plane and hold their concentration. This will help them to practice keeping their eye contact even in social occasions. Also they have to look out for upcoming kites and birds which could block their way. So they have to keep full attention toward their target thus practicing long term attention skills.

They will also acquire imitation skills. They are often facing difficulty copying or fail to follow instruction due to lack of imitation skills. While using leap motion with the aeroplane they will be learning to follow specific instruction of where to go with the plane and sometimes have to follow an object. With the continuous practice with these instruction they will overcome their fear of social interact as they will then be able to freely imitate their peers. It will motivate them to imitate acts in schools or at home on the things they see and observe.

Furthermore, they will be benefitted from improvement in their depth of perception skills, sense of coordination and coordinial movements, motivation towards social role or join attention skill. In brief this game will make ASD children more positive, confident and social.

Some pictures of this game are given below:

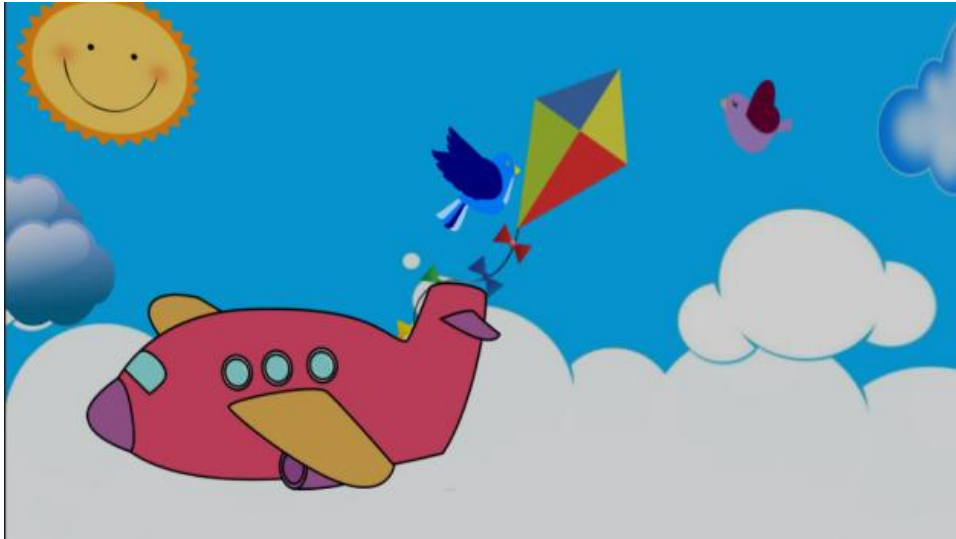


Fig 4.2.4(a): pictures of “Ride in Aeroplan”

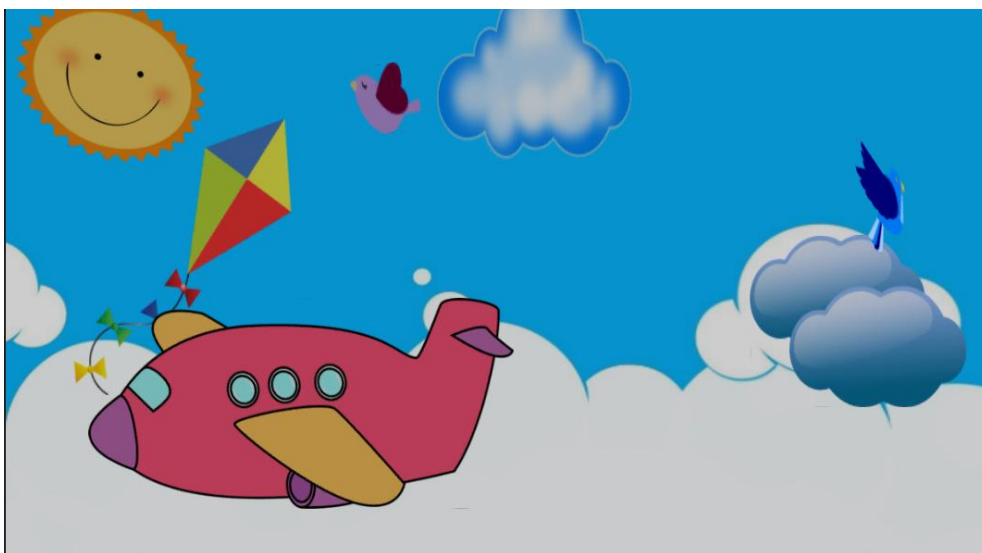


Fig 4.2.4 (b): pictures of “Ride in Aeroplan”

4.3 Game III: Body Parts Rhymes

4.3.1 Purpose of Making “Body Parts Rhymes”

It is found from 2004’s research from Journal of Music Therapy that music used for children and teens who are suffering from ASD can improve their social behaviors, increase focus and attention, increase communication attempts (vocalizations, verbalizations, gestures, and vocabulary), reduce anxiety and improve body awareness and coordination. Many additional studies have found that children and adults with autism spectrum disorders (ASD) respond well to music. It helps them to overcome sensory or motor deficiencies. Often, individuals with autism respond positively to music when little else is able to get their attention, which makes music a potential therapeutic tool.

Research from the journal “Frontiers in Integrative Neuroscience” proposes a rationale for how rhythmic input can improve sensor motor functioning and overall growth in areas such as cognition, behavior, social skills, and communication. Because movement is critical to many areas of functioning, researchers LaGasse and Hardy hypothesize that the well documented benefits of rhythm in motor rehabilitation could also be effective for individuals with autism.

As all the research shows positive outcome with the help of music, this games intention is to use that too and help the kids to learn about their own body parts. Like colors or Bengali alphabet it is confusing for children with autism to learn new words regarding their body parts. It is important for ASD children to get proper education with an effort to keep that inside their mind. The musical effects with body part names are used towards that goal of teaching children with learning deficiency to acquire knowledge.

Music encourages social interactions, improves behavior and communication. It can reduce anxiety and stress that autistic children suffer commonly due to social interactions. The purpose of this game is to use that ability of the children and help them get familiar with their own body parts and be cautious about it.

Often the autistic child gets to know the names of body-parts but fails to identify them or forgets their position due to brain functioning disorder. This game shows them the position of the body part by pointing or holding that particular organ. It is also seen that to motivate an ASD suffering children it is necessary to trigger their curiosity. Telling only the name and position might not work with some autistic children as autism comes with its uniqueness. This game also rhymes the functions so that the children can remember what they are learning and also be able to know that is the use of their body.

There are a lot of intriguing educational games which could teach autistic children about their body parts and most of them are in English or other foreign languages that do little help to Bangladeshi culture. However, the targeted player for the game is Bangladeshi children suffering from autism. The reason to develop this game in Bengali is to give the Bangladeshi children with ASD an opportunity to learn in their own language. Research shows that children learn new thing in their mother tongue more quickly than any other foreign language. Autistic children always suffer from insecurity and discomfort from all new things. So learning something in a familiar language raise their learning curve, increases their motivation and confidence. The purpose is to bring comfort during learning which will help them to concentrate more easily without any distraction.

4.3.2 Game Plan

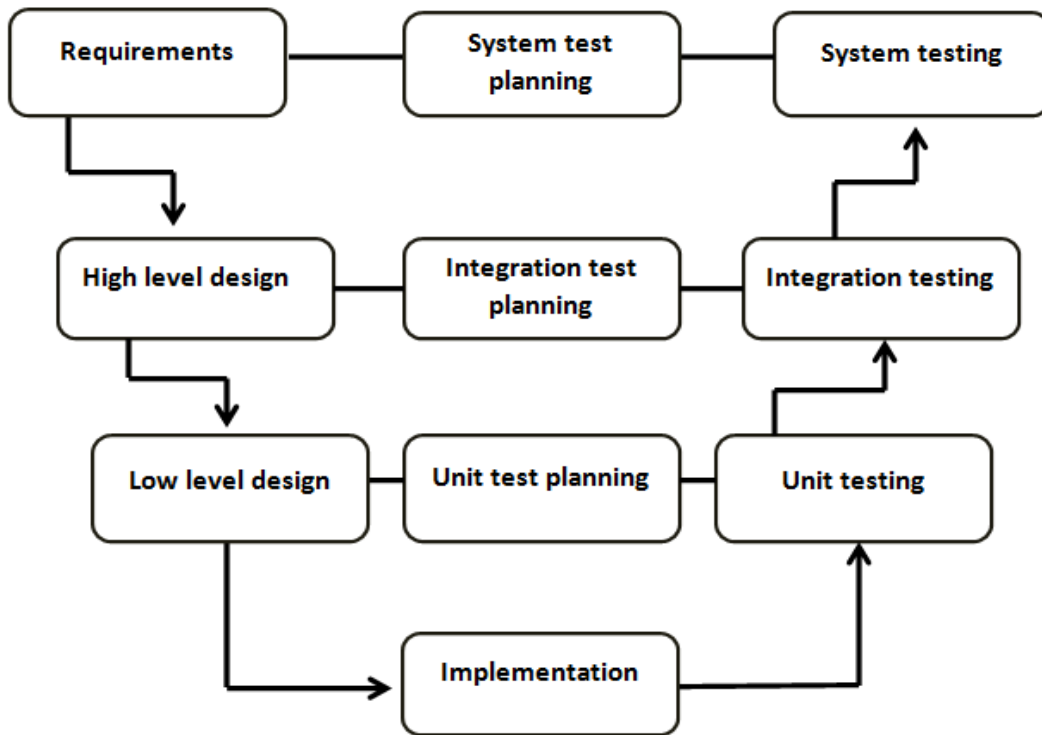


Fig 4.3.2: game plan “Body parts Rhymes”

The game plan of this is quite different from others. We have tested it several times to ensure we were going on the right way or not. We even designed it two times and tested it to ensure everything properly.

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASH over and again just to analysis the behavior of the children’s. We were observing the behavior of the children to get the information that in which way we can make the game so that it will be both easier and user friendly for them. Easier manner will make the games playful for them and they will play it more often. . So initially by going there we got the ideas of the patterns of the games. Analyzing their behavior is the most important part of the planning because we are able to know about their likings disliking and what interest them most. We came to know that they loves the usage of colors and cartoon characters are very much familiar to them so putting this things on the game will make the game

more interesting. So we planned of making the children introduce to their body parts by the usage of a Character and lots of variations of colors. Background sound is also a way of taking their attention. So while introducing to body parts we planned of using the background sound telling the individual body parts names and for what we use that particular body part. After that we started to focus on making the audios and we thought of some small sentence will appear with all the body parts telling the work of it that will make them interested to learn and memorize the body parts. So selecting the sentences for each of the body parts and making the audio was the second part of the planning. Then we estimated the most probable time of making the game prepared because a lot of work had to be done like finding suitable sentences according to the body parts, resemble them to body parts and make the game a bit interesting for them with background and colors so that they want to play the game more often. Then we estimated the time that the children will take to learn the body parts because for them it is not very easy to learn by over and night. We eventually planned to make them play the game for sixteen weeks and that would be enough for them to learn those body parts. Further we decided how many children can we have to play this game and we took over ten children to play the games for sixteen week. We decided to take only ten children because we wanted to see the real outcomes that how much this helps to learn by this particular game.

Analyzing was a very important part for making this game. Because by this, we get to know how we can make our games that will make them learn. The way they are learning in PROYASH is the main key point as they are learning in a pattern and by using the same pattern in our game will make them learn those things easily. We have analysis that they teach their students about body parts by using different types of rhymes and singing it to them. They do it in a day for couple of times and it is actually not enough for them to learn. So in the game we used all the same types of rhymes and poems that are used by PROYASH as it will be familiar to them and they could play it whenever they want which will make them to learn a bit faster. PROYASH use all the Bengali small rhymes to make them learn about the body parts work in their school and we decide to do the same in our games we also analyzed that they love to visualize. For example, when they are listening to a rhyme if there are some pictures of it or some other video or moving objects they feel very excited with it and its help them to memorizes that thing and learn easily. That is why we think of using character and color variation in our game. So we actually analyzed all the behavior of them so that we get to know about how we can make the game interesting for

them so that they play and learn. We analyzed their likings disliking and the terms and patterns of what makes them happy, what makes them learn and what makes them both interesting and joyful for them.

This game has properly been designed for the autistic children so that they can be able to play it without any kind of difficulties. This special kind of children loves to visualize the thing that they are listening that is why this game has different moving use of the body parts by the character. This game has been developed in an easy and effective manner for them as per they like the backgrounds and options. We have designed the game in a way that, with the appearances of the character the body parts appears saying the works of that body part. And these characters make the game joyful for the children and they also gets excited to know about the usage of the body parts resulting to enable them to play the game again and again. We have specially designed this character and the backgrounds so that it interests them and make them familiar to the game. We have used lots of variations of colors in the game and made the game colorful enough to interest them. Colorful things make them think in an easier way and even if they are not able to play properly it holds the concentration of them. We have structured the voice of the poems and rhymes by a child so that it catches the attention of them. These kinds of children are much more comfortable with other children rather than younger people that's why when they hear the voice of the poems they listen to it properly and try to imitate what she/he is saying resulting in learning the things we planted before them. Besides, Colors holds the concentration of them to look into the screen for a longer period of time. This game has been designed in a very user friendly way focusing only on the autistics children. The starting and exiting options of the game along with the playing method everything are very much user friendly for them. No children will be facing any difficulties while playing the game. We designed it two times to ensure the quality of game. We had done unit testing, integration testing and system acceptance testing before give the game to the special children so that we can verify it.

4.3.3 Game Details

We had to make the game character. We did not have any experience of making cartoon game character. We tried our best to make in that way it will attract the children. We made a make

cartoon for it. We had to make 11 game characters for it as we planned to show different movement of the game character. We made it in Photoshop and Illustrator. We made a normal game character at the first place. Then we make different character by modifying the previous one. For example, for showing the movement of eyes, we made a character which is winking. We had to make all the character very carefully to that the children can see the movement of the character. We were making the making to make them learn about the body parts. So it was very important to make every movement very clear. For each line of the entire rhymes, we made different character. We had made all the game character in PNG format so that we can see the background.

For making the 1st character in the game, we had to import the texture of the character in Unity Game Engine. We can give any texture to the character. We chose 1st character texture for the character. Then we made a quad component for the character. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the character. Before resize the character, we had to keep lots of things in our mind. The character should not cover the background. We added some component to make the game more attractive for the children. We had to keep space for it. As we made it for teaching them about body parts, we added the name of the body parts according to the rhymes and movement beside the character. So we had to keep space for it as well. So we had put 1 in X axes, 2 in Y axes and 1 in Z axes so the children see it properly. We had to write code in C# to change the character along with the name of the body parts and the rhymes. Then put that into the component that had been made for 1st character. Through the code, we changed the name along with the name of the body parts and the rhymes.

For making the 1st name of the body parts in the game, we had to import the texture of the character in Unity Game Engine. We had to make in it Bengali along with some cartoon to attract the children. We had to make 9 textures for it. We can give any texture to the name of the body parts. We chose the texture according to the movement of the character. Then we made a quad component for the name of the body parts. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the name of the body parts. Before resize the character, we had to keep lots of things in our mind. The name of the body parts should not cover

the background. We added some component to make the game more attractive for the children. We had to keep space for it. So we had to keep space for it as well. So we had put 1 in X axes, 2 in Y axes and 1 in Z axes so the children see it properly. We had to write code in C# to change the name of the body parts along with the movements of the character and the rhymes. Then put that into the component that had been made for 1st name of the body parts. Through the code, we changed the name along with the movements of the character and the rhymes.

We had to make audio for this game. We made the audio with the voice of eight year old child. Then we had to import all the audio into the Unity Game Engine. There are total 9 audio in this game. We made 9 game objects and save all the audio in different game object. We had to one extra component to place the code for the audio. The code is done in C#. With the help of the code, we are changing the audio every time. In the game, we had to change the audio for several time as we planned to represent the entire rhymes in it. We had added soft background music as well. We had to import the music and then we made another empty game object for it. We saved audio into the game object.

For making another component which is a cloud, we had to import the texture of the cloud in Unity Game Engine. We can give any texture to the cloud. Then we made a quad component for the cloud. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the cloud. We put 1 in X axes, 1 in Y axes, 1 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game object direction to which side and we can also decide how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

For making two birds, we had to import the texture of the birds in Unity Game Engine. We can give any texture to the birds. Then we made two quad components for the birds in different sides. We had to make two new materials where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the birds. We put 0.5 in X axes, 0.5 in Y axes and 0.5 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide

how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

For making three flowers we had to import the texture of the flowers in Unity Game Engine. We can give any texture to the flowers. Then we made two quad components for the flowers in different sides. We had to make three new materials where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the flowers. We put 1 in X axes, 1 in Y axes and 1 in Z axes. We had to fix the position for each flower.

For making two butterflies, we had to import the texture of the butterflies in Unity Game Engine. We can give any texture to the butterflies. Then we made two quad components for the butterflies in different sides. We had to fix the position of both the butterflies as we planned to give them in upper side of two flower component to make the game more attractive for the children. We had to make two new materials where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the butterflies. We put 0.5 in X axes, 0.5 in Y axes and 1 in Z axes. We added this component to make the game more interesting. We animated it with unity animation system where we need to fix in which second we want to move our game direction to which side and we can also decide how much long we want the component to be animated. After creating the animation, we had to put the animation into the component.

We had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose sky texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 7.9 in X axes, 6 in Y axes and 1 in Z axes so the children see it properly. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it.

4.3.4 Benefits of Playing “Body parts Rhymes”

Unlike magic coin this game requires no action from the children. This game will benefit them in three ways. First they will be able to know the names of the parts that their body made of and the position of them. Often it is really hard for them to coordinate the names and position. Sometimes they know all the names and position but when it is time to show while asked they found themselves confused recognizing. This is because they suffer from dyslexia.

Dyslexia is primarily associated with trouble reading. Some doctors, specialists and educators may refer to it as a “reading disorder” or a “reading disability.” But it can also affect writing, spelling and even speaking or remembering. People with dyslexia can still understand complex ideas. Sometimes they just need more time to work through the information. They may also need a different way to process the information, such as listening to an audio book instead of reading it. This game tells the name so they can listen to the names as many time as they want and recognize the body part. During the game they will see that an animated boy is telling the name of a body part and showing it. Autistic children response to color image, motion and music, they will follow the animated boy during the game and repeat the body parts. In this process they will be able to remember and learn the names and in future identify when necessary.

This game will also benefit them from dyspraxia. Dyspraxia is a general term used to cover range of difficulties affecting the initiation, organization and performance of movements. It appears to involve problems with the brain’s ability to process information which results in messages not being fully transmitted to the body. During the game the boy move his hands topoint or touch each body part he is telling. So the children have to move their eyes along with the movement.

They will also learn the process of imitation skills. While the boy is showing and telling the names the children is also motivated to do so. In this way they the prompt to follow the animated boy as the ASD children are active when showing anything with movement, music, color and picture.

In addition, they will also get to know the functions of the body parts in a rhythmic way which will increase their cognitive brain function as they are gaining knowledge. For example, the nose

it to smell, mouth is to talk and eat and eyes are to see. It is found out that knowing the purpose of an object gives a better chance to remember it for a long time.

As the times passes the children tends to use the technology which is instructed in English. Hence, they are forgetting their own mother tongue. With the help of this game the ASD children will learn Bengali words and rhymes and thus getting a step closer to enriching Bengali vocabulary. They will also get the idea that each object exist with their own function and it is unable to perform different task other than the one it has been destined for.

To sum up, this game helps the children with ASD to know the Bengali name of the body parts, its function and thus develop a consciousness about themselves and the surroundings.

Some pictures of this game are given below:



Fig 4.3.4(a): Pictures of “Body parts Rhymes”



Fig 4.3.4(b): Pictures of “Body parts Rhymes”



Fig 4.3.4(c): Pictures of “Body parts Rhymes”



Fig 4.3.4(d): pictures of “Body parts Rhymes”

4.4Game III: World of Colors

4.4.1 Purpose of Making “World of Colors”

Researcher has shown that by the age of 4 most children can identify colors and shapes. However, Child with ASD often suffers from knowing colors. They can recognize some colors but most of the times have trouble identifying colors. While learning they often become overwhelmed, irrational and confused. This game is to help them to recognize colors. The speed of information reaching children brain and allow to correctly process can be modified by color. Due to sensory integration issues autistic children’s brain fails to process five senses and responds to them as quickly as a normal child. However, color helps them to adopt and understand things more deeply and increase their communication ability with people. It is often seen that knowing colors leads them to discover more color combination that can be found from three major colors. This discovery makes them motivated and encouraged them in daily functioning. It is hard to teach them about colors properly. They get easily confused with the names and property of the color. Through this game, they will be able to know about colors with example and audio. It will help them to remember and recognize colors in an easier way as they will see colors on everyday things like cars, trees or flowers. Neurologists those work with

autistic children found out that they can sometimes be helped by using color. Especially red seems to help because it counteracts the over firing of the high and mid brain. Research also shows that colors help them to control their emotions. For example if the child has an angry or emotional reaction to loud noises such as a dog barking, color may help. Color also help to counter with dyslexia and help overcome of reading and learning deficiency. Combining color with pictures give tremendous changes towards ASD children's brain development. Pictures are especially meaningful to children with autism because pictures can help them to express themselves more easily. Pictures relating to the child's environment provide opportunities for functional (everyday) communication.

The game also designed to give children basic knowledge of common colors. For example, the sky is blue and black and it cannot be anything else like purple or violet. This is designed to help them cope with the everyday life by practicing on-screen. It is also seen that some autistic children react to specific color. They sometimes find it difficult to look at specific color as it might bring discomfort to them or give them hard time in daily life. So the purpose of this game is to understand which color bothers the children emotionally and is it possible to overcome the discomfort through seeing it over and over again. The intention of this game is to help them face their discomfort through learning it and seeing the color in familiar object.[2]

4.4.2 Game Plan

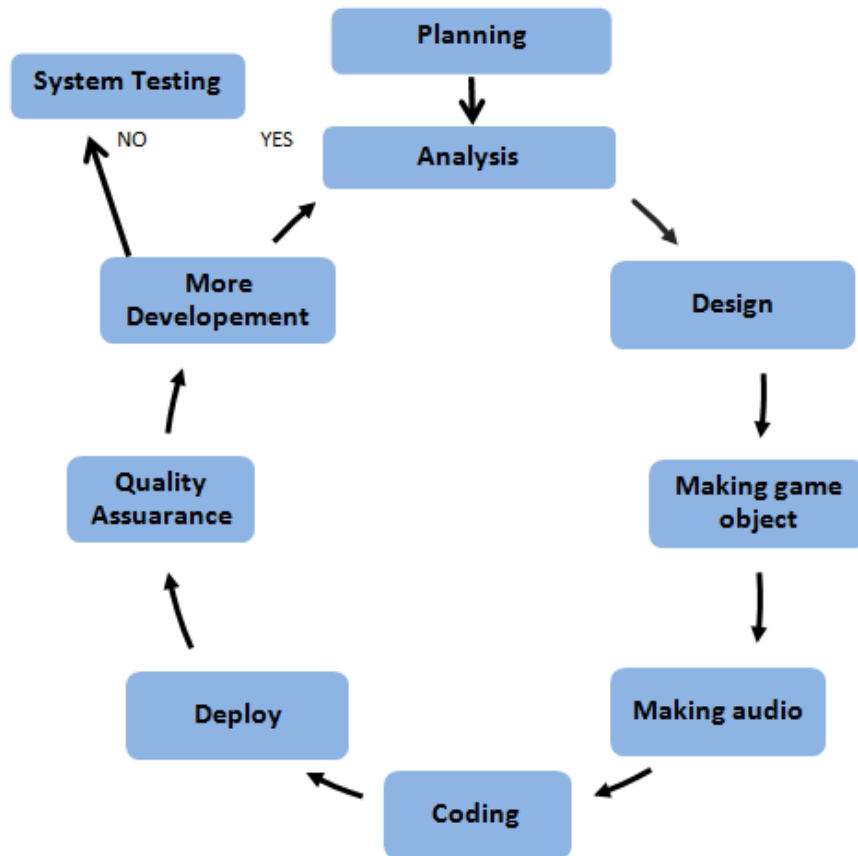


Fig 4.4.2: game plan of "World of Colors"

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASHover and again just to analysis the behavior of the children's. We were observing the behavior of the children to get the information that in which way we can make the game so that it will be both easier and user friendly for them. Easier manner will make the games playful for them and they will play it more often. . So initially by going there we got the ideas of the patterns of the games. Analyzing their behavior is important part of the planning because we are able to know about their liking and disliking and what interest them most. We came to know that they love the usage of colors so putting variation of colors on the game will make the game more interesting. So we planned of teaching them about colors that they need in their daily activities. Background sound is also a way of taking

their attention. So we planned to teach the children about colors of different objects by using the background. After that we started to focus on making the audios. So selecting some examples related to their familiar objects for different colors and making the audio was the second part of the planning. Then we estimated the most probable time of making the game prepared because a lot of work with variation of colors has to be done. We planned to make the game a bit interesting by using a colorful background so that it makes them interested to play the game more often. Then we estimated the time that the children will need to properly recognize all the colors with the examples. We eventually planned to make them play the game for sixteen weeks and that would be enough for them to recognize the colors. Further we decided how many children can we have to play this game and we took over ten children to play the games for sixteen weeks. We decided to take only ten children because we wanted to see the real outcomes that how much this helps to learn by this particular game.

Analyzing was a very important part for making this game. Because by this, we get to know how we can make our games that will make them learn. The way they are learning in PROYASH is the main key point as they are learning in a pattern and by using the same pattern in our game will make them learn those things easily. We analyzed that they teach their students about colors by using different types of name of the color and example of color. They do it in a day for couple of times and it is actually not enough for them to learn. So in the game we used all the same types of examples that are used by PROYASH as it will be familiar to them and they could play it whenever they want that will make them learn a bit faster. PROYASH uses all the small examples to tell about the colors and we decide to do the same in our games. We also analyzed that they love to visualize. For example, when they are listening to examples if there are some pictures of it or some other video or moving objects they feel very excited with it and it helps them to memorize that thing and learn easily. That is why we think of using lots of color variation with the objects in our game. So we actually analyzed all the behavior of them so that we get to know about how we can make the game interesting for them so that they play and learn. We analyzed their likings, disliking and the terms and patterns of what makes them happy, what makes them learn and what makes them both interesting and joyful for them.

This game has properly been designed for the special children so that they can be able to play it without any kind of difficulties. This special kind of children loves to visualize the thing that they are listening that is why this game has different moving texture of objects. This game has been developed in an easy and effective manner for them as per they like the backgrounds. We have designed the game in a way that, with the appearances of different colored objects with the name of color and examples. Each color will have two examples. We have backgrounds so that it interests them and make them familiar to the game. We have used lots of variations of colors in the game and objects colorful enough to interest them. Colorful things make them think in an easier way and even if they are not able to play properly it holds the concentration of them. We have structured the voice of the name and examples of the color by a child so that it catches the attention of them. These kinds of children are much more comfortable with other children rather than younger people. Besides, Colors holds the concentration of them to look into the screen for a longer period of time. This game has been designed in a very user friendly way focusing only on the autistics children. The starting and exiting options of the game along with the playing method everything are very much user friendly for them. No children will be facing any difficulties while playing the game.

We had to make objects and audio for the game. We had made colorful game objects for the children to attract to play the game. In the entire game we have used audios. For audios, we have recorded the voice of eight years old child. We had to put code to change the background, name of the colors, examples of the colors and to change the audio. Then we made the entire game in deploy part. We had done quality assurance before give the game to the special children so that we can verify it. We show the games to PROYASH and the when they ensured the quality, we gave the game to the children.

4.4.3 Game Details

This game is mainly made for helping in teaching them in learning colors. We chose different background for each color. There are nine colors and each of them two examples.

We had to make the first for starting the game background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. Then we made a Quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 20 in X axes, 20 in Y axes and 8 in Z axes so the children see it properly. We made 24 backgrounds for this game on the game. With each color, there will be different background along with the name of the color. For making the name of 1st color, we had to make the texture. We made it in Bengali along with some cartoon to attract the children. We had to import the texture of the background in Unity Game Engine. We can give any texture. We chose “RED” as the 1st name of colors. Then we made a quad component. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the component. Before resizing it, we had to keep lots of things in our mind. We had to make it in that way so it does not cover the background and there we had to keep space for name of the examples and the picture of the example. So we had put 6 in X axes, 5 in Y axes and 1 in Z axes so the children see it properly. There are name of nine colors. So we had to make name of nine colors. We had to write code in C# to change the name of the color along with the name of the example and the picture of the example. Then put that into the component that had been made for the name of color. Through the code, we changed the name along with the name of the example and the picture of the example.

For making the name of 1st example, we had to make the texture. We made it in Bengali along with some cartoon to attract the children. We had to import the texture of the background in Unity Game Engine. We can give any texture. We chose “Flower” as the 1st example of red. Then we made a quad component. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the component. Before resizing it, we had to keep lots of things in our mind. We had to make it in that way so it does not cover the background and there we had to keep space for the picture of examples. So we had put 5 in X axes, 4 in Y axes and 1 in Z axes so the children see it properly. There are 18 name of example as we had given two examples for

each game. So we had to make 18 name of example. We had to write code in C# to change the name of the example along with the name of the color and the picture of the example. Then put that into the component that had been made for the name of the example. Through the code, we changed the picture along with the name of the color and the picture of the example.

For making the picture of 1st example, we had to make the texture. We had to import the texture of the background in Unity Game Engine. We can give any texture. We chose “RED Flower” as the 1st picture of example because name was flower and color was red. Then we made a quad component. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the component. Before resizing it, we had to keep lots of things in our mind. We had to make it in that way so it does not cover the background so we had put 5 in X axes, 4 in Y axes and 1 in Z axes so the children see it properly. There are 18 name of example as we had given two examples for each game. So we had to make 18 picture of example as well. We had to write code in C# to change the picture of the example along with the name of the color and the name of the example. Then put that into the component that had been made for the picture of the example. Through the code, we changed the picture along with the name of the color and the name of the example.

We had made particles to attract the children.. We made colorful particles. Then we saved the particles into the background. Children will be able to see the particles entire time while playing the game. We had to make audio for this game. We made the audio with the voice of eight year old child. Then we had to import all the audio into the Unity Game Engine. There are total 30 audio in this game. We made 30 empty game object and save all the audio in different game object We had to one extra component to place the code for the audio. The code is done in C#. With the help of the code, we are changing the audio every time. In the game, we had to change the audio for several time. Sometimes in the game we are saying only the name of the color, sometimes the name of the example. To relate it with the name of the color and the example, we had to change it.

4.4.4 Benefits of Playing “World of Colors”

Though this is not a traditional game where the children have to interact or play as they should in usual game, it has some major benefits that will trigger their social interaction and motivation. First of all, they meet the main purpose of the game - recognizing color. As it usual for autistic children to confuse identifying colors the first step is to know all the color names. This game shows several colors and repeats few times so that they could hold the children’s attention. In order to learn and recognize colors the game repeat colors over and over again. As they are slow learner, with this game they can repeat the colors without needing any external help and learn them efficiently.

The second thing they get from this game is the name of everyday objects. The game not only show colors but also shows that particular color in different object. It also mentions the name of that object. It helps them to know about their surroundings that they see every day. The car, pen, sky, flowers are the object they see every day but fails to understand and know their name. It is possible that they see these objects every day and nobody bothers to tell them that these objects are individually recognizable through a name. By the end of this game they know the names of what they see in the streets and around them. Also as they are curious enough, they ask questions about these objects to know more about their function. In this way this game help them to interact with their surrounding and show their curiosity.

The third thing they learn is the usual color corresponding to the objects. They often fail to understand the realistic color combination for example the blood is always red or that the car can be of many colors. During this game they recognize color and what could be usual possible object with that color. Hence, they will be able to distinguish usual with unusual object and gives their own opinion. They also develop a free mind where they can thing of an object with their favorite color they learned from the game. This will enhance their confidence and broaden then memory lane.

Moreover, it is seen that the autistic children reacts with colors differently. With the help of this game they will understand which color they like and which they don’t. As a result they will

practice their freedom of mind and consciousness. This will give them an opportunity to express them and interact with people which they find it difficult to do.

Lastly it will help them overcome detest if they have towards any specific color. Autistic children often hold strong emotional opinion for example they can't stand what they don't like. Often this creates social awkwardness and interaction difficulty. During the learning procedure they will be able to face their incompetency to endure. This way they will learn to deal with any disagreement in social environment.

Some pictures of this game are given below:

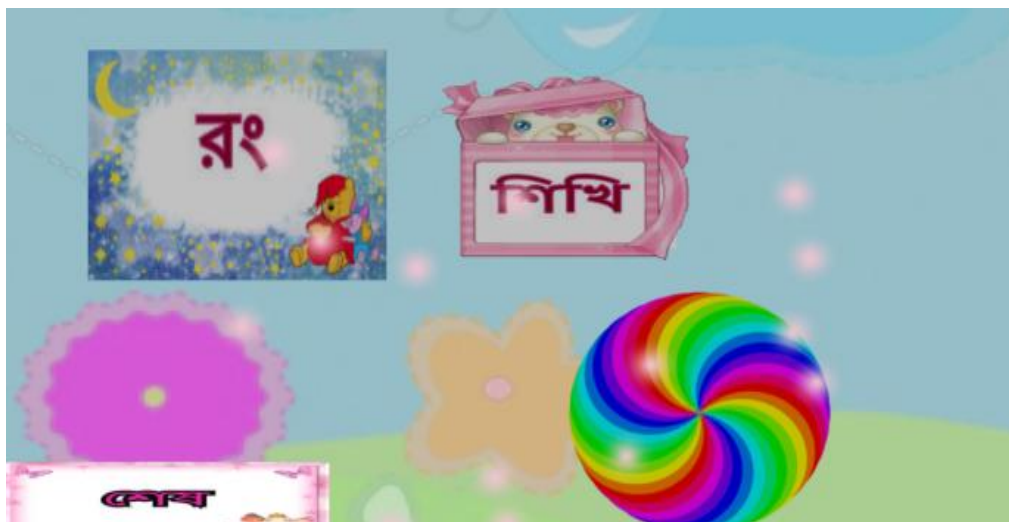


Fig 4.4.4(a): pictures of “World of Color”



Fig 4.4.4(b): pictures of “World of Color”



Fig 4.4.4(c): pictures of “World of Color”



Fig 4.4.4(d): pictures of “World of Color”

4.5 Game V: Play with Doreamon and Mario (knowing about directions)

4.5.1 Purpose of Making “Play with Doreamon and Mario”

The Picture Exchange Communication System (PECS) is a popular communication-training program for young children with autism spectrum disorders (ASD). This meta-analysis reviews the current empirical evidence for PECS in affecting communication and speech outcomes for children with ASD. As autistic children are slow at learning and decision making, this game is intended to give them opportunity to express the position through animated cartoons.

Children are fond of cartoons and they tend to make some cartoon characters their imaginary friend. It is seen by the research that using friendly images help autistic children to learn more quickly as they are comfortable with the environment.

Since they suffer from dyslexia they get confused with the directions. What is front, back, left, right, up or down they find it difficult to grasp on. They often confused the directions as their brain does not help them to coordinate quickly due to sensory integration issues. The game introduces two more cartoon characters and teaches them the positions in Bengali.

It is also designed to test what they have learned at the same time after some repetition. Children are often taught in class about direction and position. However, teacher and parents prefer not to repeat 50 times. A parent of an autistic children mentioned in a blog that she has to repeat one preposition 50 times before her 12 year boy can remember it. In Bangladesh there is rarely seen that parents of teacher is repeating that many time. This is the reason this game is designed in a repetitive manner and followed by a mini quiz to force them to remember what they are learning.

Children are often forgetful and inattentive during learning process. This symptom is very high with autism. However, with colorful pictures, animated friendly faces and repetition makes it possible for the children to learn. This game is designed exactly that way to help them learn about up-down, in-out, front-back, left-right etc.

Here again comes the issue of Bengali language. It a mother tongues for the children having autism. Presenting a game in their own language brings a familiar comfort to their life. As a result the game language is kept Bengali and all the word has been written in Bengali so that children can familiar themselves with the spelling of the words and the structure of the sentence.

4.5.2 Game Plan

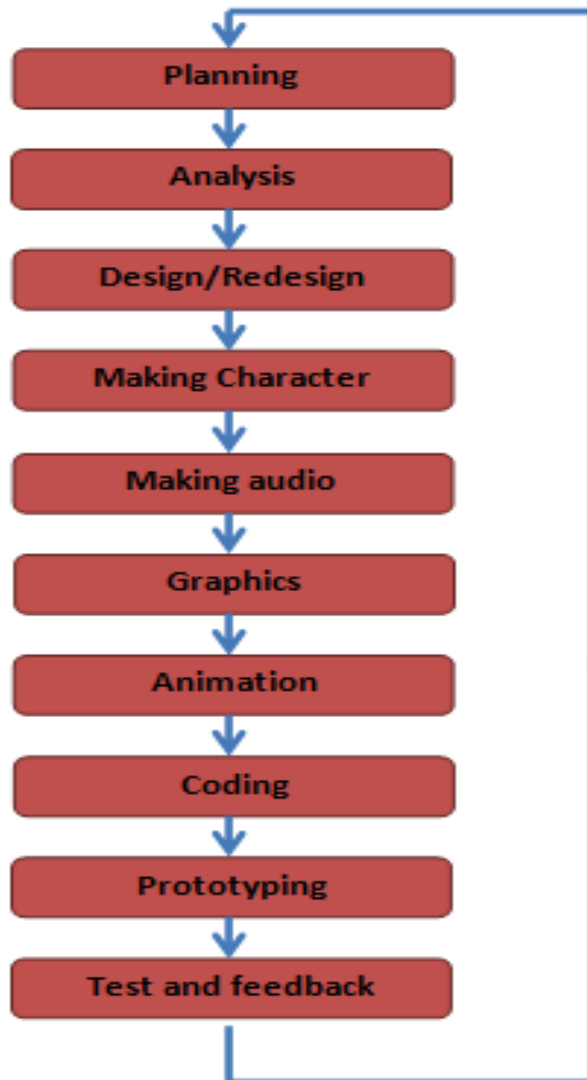


Fig 4.5.2: game plan of “Play with DoreamonandMario”

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASHover and again just to analysis the behavior of the children’s. We were observing the behavior of the children to get the information that in which way we can make the game so that it will be both easier and user friendly for them. Easier manner will make the games playful for them and they will play it more often. . So initially by going there we get the ideas of the patterns of the games. Analyzing their behavior is the most important part of the planning because we are able to know about their likings disliking

and what interest them most. We came to know that they loves the usage of colors and cartoon characters are very much familiar to them so putting this things on the game will make the game more interesting. So we planned of making the children introduce to the directions that they need in their daily activities by using a cartoon Character Doreamon and lots of variations in colors. Background sound is also a way of taking their attention. So while introducing the directions we planned of using the background sound telling about each of the directions for three times so that it makes them easier to memories. After that we started to focus on making the audios as the sound catches the attentions of them very easily and we thought of some small sentence will appear with all the directions telling aboutwhere the direction is going and immediate after asking about the cartoon character's position just to ensure whether they are learning or not. So we planted the cartoon character showing the directions which will make them interested to learn and memorize the directions. Selecting some sentences saying each of the directionsand making the audio was the secondond part of the planning. Then we estimated the most probable time of making the game prepared because a lot of work had to be done like selecting some interesting sentences according to different directions, resemble them to the directions and make the game a bit interesting for them with background and colors so that they want to play the game more often. Then we estimated the time that the children will take to learn the directions because for them it is not very easy to learn by over and night. We eventually planned to make them play the game for sixteen weeks and that would be enough for them to learn those directions. Further we decided how many children can we have to play this game and we took over ten children to play the games for sixteen week. We decided to take only ten children because we wanted to see the real outcomes that how much this helps to learn by this particular game.

Analyzing was a very important part for making this game. Because by this, we get to know how we can make our games that will make them learn easily. The way they are learning in PROYASHis the main key point as they are learning in a pattern and by using the same pattern in our game will make them learn those things easily. We have analysis that they teach their students about directions by using different types of rhymes and singing it to them. They do it in a day for couple of times and it is actually not enough for them to learn. So in the game we used all the same types of rhymes and poems that are used by PROYASHas it will be familiar to them and they could play it whenever they want which will make them to learn a bit faster. And especially in this game we have repeated all the directions for three times to ensure the learn it.

PROYASH used all the Bengali small rhymes to make them learn about directions in their school and we decide to do the same in our games we also analyzed that they love to visualize. For example, when they are listening to a rhyme if there are some pictures of it or some other video or moving objects they feel very excited with it and it helps them to memorize that thing and learn easily. That is why we think of using the cartoon character Doreamon and color variation in our game. So we actually analyzed all the behavior of them so that we get to know about how we can make the game interesting for them so that they play and learn. We analyzed their likings disliking and the terms and patterns of what makes them happy, what makes them learn and what makes them both interesting and joyful for them.

This game has properly been designed for the autistic children so that they can be able to play it without any kind of difficulties. This special kind of children loves to visualize the thing that they are listening that is why this game has different moving use of the directions by the character Doreamon. This game has been developed in an easy and effective manner for them as per they like the backgrounds and options. We have designed the game in a way that, with the appearances of the cartoon character Doreamon the direction appears saying where it is going for three times and after that asking about the cartoon's position just to test what they learned. These characters make the game joyful for the children and they also get excited exploring different directions resulting to enable them to play the game again and again. We have specially designed this character and the backgrounds so that it interests them and make them familiar to the game. We have used lots of variations of colors in the game and made the game colorful enough to keep the attention of them. Colorful things make them think in an easier way and even if they are not able to play properly it holds the concentration of them. We have structured the voice of the rhymes saying about directions by a child so that it catches the attention of them. These kinds of children are much more comfortable with other children rather than younger people that's why when they hear the voice of the rhymes they listen to it properly and try to imitate what she/he is saying resulting in learning the things we planted before them. Besides, Colors holds the concentration of them to look into the screen for a longer period of time. This game has been designed in a very user friendly way focusing only on the autistic children. The starting and exiting options of the game along with the playing method everything are very much user friendly for them. No children will be facing any difficulties while playing the game.

We had to make objects, character and audio for the game. We had to animate the character as well. We made the game character in Photoshop and Illustrator. We had made colorful game objects for the children to attract to play the game. We had to make different game objects for question and option. In the entire game we have used audios. For audios, we have recorded the voice of eight years old child. We had to put code to change the question with different options, to animate the character, to change the audio and to change the levels,. Then we made the entire game and made prototype.

Testing is most important after the game has been designed. After the game has been properly made we our-self played the game couple of times before giving them to play. We ensured the easiness of the game over and over so that they won't face any difficulties. After much of assurance we made the game play by other normal children. This was actually the part of our testing program to see how the normal children play our games and what their feedbacks were. We saw that all the children were able to play the game properly with no difficulties and to many of them it was easy and fun as well some of them were able to recall the direction. Then we were assured that this game could be played by them and it will help them in their learning process. Then finally we give them the game to play and their responses were remarkable. They were very happy to see the colorful theme and background cartoon with the moving object. Many of children listened to the small poems with concentrations. They were able to finish the entire game. We had implemented the game on 10 children for months and the result was outstanding with a great progress rate over the weeksand thus the children were able tolearn direction When we are done with the testing then we implemented the game on the special children.

4.5.3 Game Details

In this game we had to make 25 different levels, 18 audio, 4 characters according to our plan. We recorded the voice of eight year old child for all level. In the 1st level we made a front page for it. We started with a new scene. We had to make a background for it at the first place. We had to import the texture of the background in Unity Game Engine. We can give any texture to the obstacle. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the martial to in the component. By

doing it, we got our desired texture. Then we had to resize the background. We put 315 in X axes, 203 in Y axes, 1.5 in Z axes. Then we put the name of the games in Bengali. We had to make it in Bengali. Then we imported it into Unity and save the texture as we saved the background. Then we had to resize it. We had to make it smaller than the background. We put 50 in X axes, 10 in Y axes, 0.1 in Z axes. Then we had to make buttons. We imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. Then we put a code in C# to go the next level. We named it “start”. If anyone does not want to start the game den the person can escape, then it will be exited. It is being added by code. We added soft music and an audio in it. For that we had to import the music and the audio that we wanted to add into Unity Game Engine. Then we had to make two empty game objects and then save the audio into it. We planned to give the two characters as well in the front page to introduce them to the children. We made four characters for it as we wanted to animate it as well. We made it in Photoshop and Illustrator. We made a normal game character at the first place. Then we make different character by modifying the previous one. We had made all the game character in PNG format so that we can see the background. We had to make it very carefully so that the animation can be visible to the children.

We made 3 levels to teach each direction with question. So in total, we made 24 levels to teach 8 directions. The first three levels are made to teach them about left-right direction and the question is about right side.

We took new scene and named it “always 4”. We had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose colorful texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 183 in X axes, 115 in

Y axes and 1 in Z axes so the children see it properly. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it. We made this level to introduce our two game characters “Doreamon” and “Mario”. So we had to add two more audios into it. We wanted the children to hear it properly. So we repeat their introduction twice. For that we had to import the two audios we wanted to add into Unity Game Engine. Then we had to make four empty game objects and then save the audios into them. Then by coding, the audios have been changed along with the animation of the character. To animate the characters, we made four characters for it. We made it in Photoshop and Illustrator. We made a normal game character at the first place. Then we make different character by modifying the previous one. We had made all the game character in PNG format so that we can see the background. We had to make it very carefully so that the animation can be visible to the children. We animated it with code. This level will stay for 20 second. Then it will go to the next level where we will teach them left-right direction.

We took new scene and named it “dan”. We had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose colorful texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 200 in X axes, 120 in Y axes and 1 in Z axes so the children see it properly. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it. We made this level to teach them left-right direction our two game characters “Doreamon” and “Mario”. So we had to add two more audios into it. We wanted the children to hear it properly. So we repeat each audio for three times. For that we had to import the two audios we wanted to add into Unity Game Engine. Then we had to make six empty game objects and then save the audios into them. Then by coding, the audios have been changed along with the animation of the character. To animate the characters, we made four characters for it. We made it in Photoshop and Illustrator. We made a normal game character at the first place. Then we make different character by modifying the previous one. We had made all the game character in PNG format so that we can see the background. We had to

make it very carefully so that the animation can be visible to the children. We animated it with code. This level will stay for 36 second. Then it will go to the next level where we will ask question to test that they had learnt it or not.

We took new scene and named it “dan 1”. We had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose colorful texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 200 in X axes, 120 in Y axes and 1 in Z axes so the children see it properly. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it. We made this level to ask them about left-right direction with our two game characters “Doreamon” and “Mario”. So we had to add one more audio into it. We wanted the children to hear the question properly. So we repeat audio for three times. For that we had to import the audio we wanted to add into Unity Game Engine. Then we had to make three empty game objects and then save the audios into them. Then by coding, the audios have been changed along with the animation of the character. To animate the characters, we made four characters for it. We made it in Photoshop and Illustrator. We made a normal game character at the first place. Then we make different character by modifying the previous one. We had made all the game character in PNG format so that we can see the background. We had to make it very carefully so that the animation can be visible to the children. We animated it with code. . Then we had to make three options according to our plan. Made a texture of the buttons in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the buttons. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. Then we put a code in C# to go the next level if the answer is correct. If anyone wants to quit the game any moment, they can press escape button. Then we had to import the texture of the question in Unity Game Engine. We can give any texture to the question. We chose question for the right side according to our plan. Then we made a quad component for the question. We had to make a

new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the question. So we had put 21 in X axes, 4 in Y axes and 1 in Z axes so the children see it properly.

In the same pattern, we made all other levels to teach them other direction

4.5.4 Benefits of Playing “PlaywithDoreamonandMario”

This game meets the purpose of dealing with direction for the autistic children. It shows the animated character and asks the player where their position is. This game benefits the children in two ways.

Firstly, they get to recognize the direction and use them to interact with day to day life. In their everyday life they have to use the position and direction most. Even when they are learning about their body parts the position was a main factor for them to consider.

Learning and not being confused with 10 directions and several opposing position is a challenge for children with autism. Through this game they will get plenty time to exercise the directions by repeating and answering question after each new direction.

Secondly, they get to distinguish two characters and know the names of them as they are answering the question of their position. The difficult part for the autistic child is to coordinate their brain and eyes. They might see something and the response is most of the time delayed due to their incompetency with processing information in the brain due to sensory integration disorder. So when the game asks ‘who is in the right side?’, recognizing that Mickey is standing right shows that the child is able to correspond his eyes with brain and able to formulate a response.

Presenting two characters also introduces a new emotional trait to the autistic children. Often the children suffering from Asperger's syndrome are unfamiliar with some emotional traits for example choosing the most favorite one between two. During this game they will be able to express their opinion about which character they like most from the visuals and thus they become more confident showing their opinion.

During the games parents are encourage to ask them different questions about the position and direction. As a result the relationships between parents-children become closer which boost up the confidence level of autistic children.

Some pictures of this game are given below:



Fig 4.5.4(a): pictures of “Play with Doreamon and Mario”



Fig 4.5.4(b): pictures of “Play with Doreamon and Mario”



Fig 4.5.4(c): pictures of “Play with Doreamon and Mario”



Fig 4.5.4(d): pictures of “Play with DoreamonandMario”

4.6 Game VI: Let’s Play with Mili

4.6.1 Purpose of Making “Let’s Play with Mili”

This game is the continuum of the game three ‘World of colors’. In the game three the children with autism is only learning and recognizing the color with its corresponding object, this game is purposed to test their ability to identify them through their learning. It is a common thing to forget stuff even for a normal people. According to Ebbinghaus’s forgetting curve it can be seen that the information learned is gradually lost over time and this curve is true for all person. Whereas autistic children are already suffering from dyslexia, their forgetting curve is very steep. This game is intend to increase the memory time span of remembering color through music and objects.

As mentioned before the color effect autistic children than any other method and its helps their brain to work actively. This game is design to use to see how much they know about colors and

if they can correspond the actual color by visualizing and remembering it from their memory. As the game is in Bengali, it is designed to understand the Bengali name of the object and match with the correct color.

In educational institution it is common to test the knowledge they give after some time span in order to see the performance of the student. This whole process is very unfamiliar for autistic children. So before they face the real school test experience this game is designed to help them adopt the idea of testing. Simple questions of color and object what they already learned through previous games helps them understand the testing process.

Another purpose of the game is to appreciate the success of the children. It is often seen if an autistic children is congratulated or appreciated they find motivation in tasks. This game claps and appreciates each correct answer and show no change if the answer is wrong.

It is said several times in different research paper that each autistic children is unique. It is possible that one way of teaching them the color does not do much help. This game helps to determine if the child is better at learning through exercising or just by listening. Each time the cartoon character Mili asks what the color of an object is and by answering them they are able to test their judgment of recognizing color.

Children suffering from Asperger's disorder or simply speaking autism shows delay in development of many basic skills. However, researcher shows that animated cartoon characters help them develop faster than usual. This game another purpose is to introduce animated character Mili so that the children become friendlier towards the game and thus modify the learning curve.

4.6.2 Game Plan

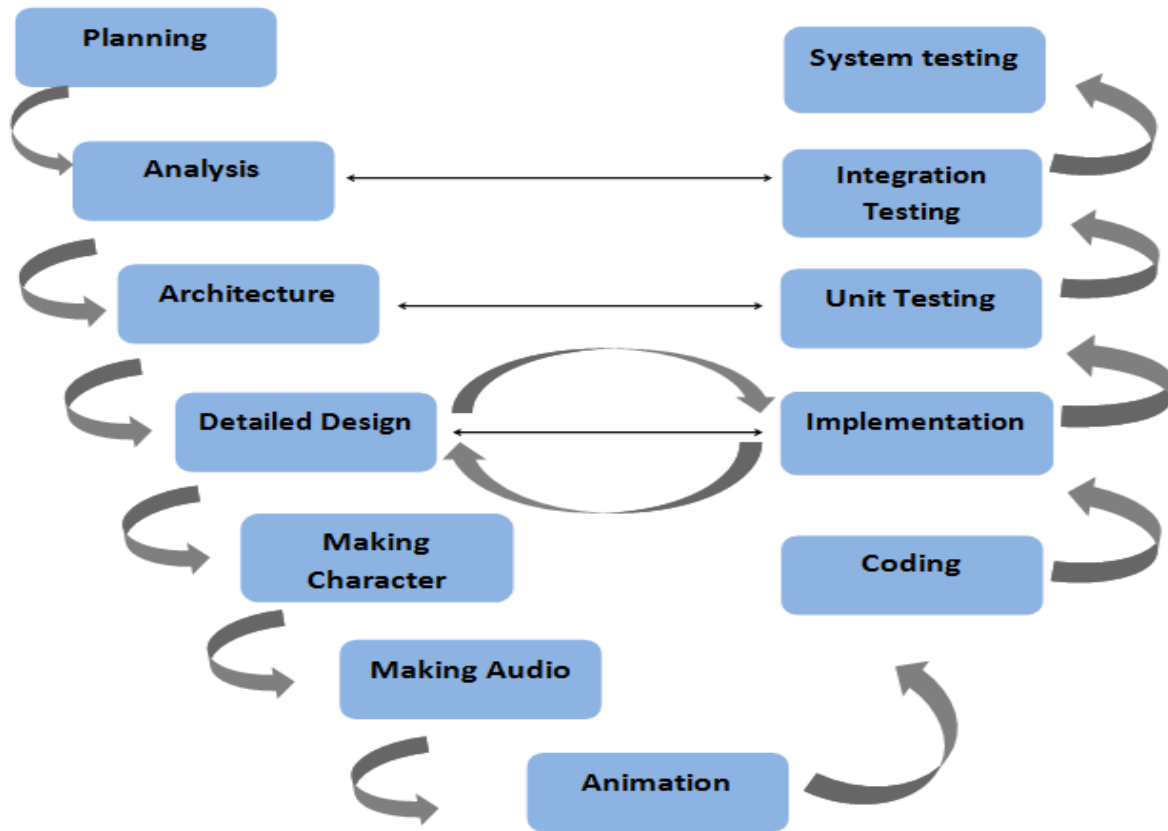


Fig 4.6.2: game plan of “Let’s Play with Mili”

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASHover and again just to analysis the behavior of the children’s. We were observing the behavior of the children to get the information that in which way we can make the game so that it will be both easier and user friendly for them. Easier manner will make the games playful for them and they will play it more often. So initially by going there we got the ideas of the patterns of the games. Analyzing their behavior is important part of the planning because we are able to know about their likings disliking and what interest them most. We came to know that they love the usage of colors so putting variation of colors on the game will make the game more interesting. So we planned of testing the children about colors by asking them questions about a character Mili and certain objects and measure if they are able to recognize different colors or not. Background sound is also a way of taking their

attention. So we planned of asking the children about colors of different objects by using the background voice of cartoon character Mili. After that we started to focus on making the audios and we thought of asking some small question related to colors of some objectives that will appear with Mili which will make them recognize the colors easily. So selecting some questions related to their familiar objects for different colors and making the audio was the second part of the planning. Then we estimated the most probable time of making the game prepared because a lot of work with variation of colors has to be done. We planned to make the game a bit interesting by using colorful backgroundso that it makes them interested to play the game more often. Then we estimated the time that the children will need to properly recognize all the colors and answer the questions and for that we planned the game such a way that, they cannot proceed to the next level until the correspondent levels answer is not given rightly. We eventually planned to make them play the game for sixteen weeks and that would be enough for them to recognize the colors. Further we decided how many children can we have to play this game and we took over ten children to play the games for sixteen week. We decided to take only ten children because we wanted to see the real outcomes that how much this helps to learn by this particular game.

Analyzing was a very important part for making this game. Because by this, we get to know how we can make our games that will make them learn. The way they are learning in PROYASH is the main key point as they are learning in a pattern and by using the same pattern in our game will make them learn those things easily. We have analysis that they teach their students about colors by using different types of rhymes and singing it to them. They do it in a day for couple of times and it is actually not enough for them to learn. So in the game we used all the same types of rhymes and poems that are used by PROYASHas it will befamiliar to them and they could play it whenever they want that will make them learn a bit faster. PROYASHuse all the Bengali small rhymes to tell about the colors and we decide to do the same in our games. We also analyzed that they love to visualize. For example, when they are listening to a rhyme if there are some pictures of it or some other video or moving objects they feel very excited with it and its help them to memorizes that thing and learn easily. That is why we think of using character Mili and lots of color variation with the objects in our game. So we actually analyzed all the behavior of them so that we get to know about how we can make the game interesting for them so that

they play and learn. We analyzed their likings disliking and the terms and patterns of what makes them happy, what makes them learn and what makes them both interesting and joyful for them.

We had to make a proper architecture for this game. Color is being taught to them in other way and we had to a proper architecture so that we can help them in learning it easily. We made the entire architecture to visualize the whole plan so that we can make it in time.

This game has properly been designed for the special children so that they can be able to play it without any kind of difficulties. This special kind of children loves to visualize the thing that they are listening that is why this game has different moving texture of objects and the character Mili. This game has been developed in an easy and effective manner for them as per they like the backgrounds and options. We have designed the game in a way that, with the appearances of different colored objects and the character, the children will be able to recognize them. If not they will not proceed to the next level and the same level will be repeated. The character Mili and different colored objects make the game joyful for the children resulting to enable them to play the game again and again and learning through it. We have specially designed this character and the backgrounds so that it interests them and make them familiar to the game. We have used lots of variations of colors in the game and made the game character and objects colorful enough to interest them. Colorful things make them think in an easier way and even if they are not able to play properly it holds the concentration of them. We have structured the voice of the poems and rhymes by a child so that it catches the attention of them. These kinds of children are much more comfortable with other children rather than younger people that are why when they hear the voice of the poems they listen to it properly and try to imitate what she/he is saying resulting in learning the things we planted before them. Besides, Colors holds the concentration of them to look into the screen for a longer period of time. This game has been designed in a very user friendly way focusing only on the autistics children. The starting and exiting options of the game along with the playing method everything are very much user friendly for them. No children will be facing any difficulties while playing the game.

We had to make objects, character and audio for the game. We had to animate the character as well. We made the game character in Photoshop and Illustrator. We had made colorful game objects for the children to attract to play the game. We had to make different game objects for question and option. In the entire game we have used audios. For audios, we have recorded the

voice of eight years old child. We had to put code to change the question with different options, to animate the character and to change the audio. Then we made the entire game in implementation part. We had done unit testing, integration testing and system acceptance testing before give the game to the special children so that we can verify it. If we found something wrong in the unit testing, we went back to detailed design to fix it as we had shown into the figure 4.6.2.

4.6.3 Game Details

In this game we had to make 13 different levels, 6 audio, 34 characters according to our plan. We recorded the voice of a eight year old child for all level. In the 1st level we made a front page for it. We started with a new scene. We had to make a background for it at the first place. We had to import the texture of the background in Unity Game Engine. We can give any texture to the obstacle. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the martial to in the component. By doing it, we got our desired texture. Then we had to resize the background. We put 36 in X axes, 23 in Y axes, 1 in Z axes. Then we put the name of the games in games. We had to make it in Bengali. Then we imported it into Unity and save the texture as we saved the background. Then we had to resize it. We had to make it smaller than the background. We put 5 in X axes, 1 in Y axes, 0.1 in Z axes. Then we had to make buttons. We imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. Then we put a code in C# to go the next level. We named it “1st”. If anyone does not want to start the game den the person can escape, then it will be exited. It is being added by code. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it. We planned to give the character as well in the front page so we made four characters for it as we wanted to animate it as well. We made it in Photoshop and Illustrator. We

made a normal game character at the first place. Then we make different character by modifying the previous one. We had made all the game character in PNG format so that we can see the background. We had to make it very carefully so that the animation can be visible to the children.

We took new scene and named it “yes”. We had to make a background. We had to import the texture of the background in Unity Game Engine. We can give any texture to the background. We chose sky texture for the background. Then we made a quad component for the background. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the background. Before resize the background, we had to keep lots of things in our mind. The background should be not covered with anything. So we had put 180 in X axes, 120 in Y axes and 1 in Z axes so the children see it properly. We added soft music in it. For that we had to import the music that we wanted to add into Unity Game Engine. Then we had to make an empty game object and then save the audio into it.

For making the 1st character in the game, we had to import the texture of the character in Unity Game Engine. We can give any texture to the character. We chose 1st character texture for the character. Then we made a quad component for the character. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the character. Before resize the character, we had to keep lots of things in our mind. The character should not cover the background. So we had put 50 in X axes, 60 in Y axes and 1 in Z axes so the children see it properly. We had to write code in C# to change the character along with the audio. Then put that into the component that had been made for 1st character.

For making 1st question, we had to make the texture of the question along with some colorful background to attract the children. Then we had to import the texture of the question in Unity Game Engine. We can give any texture to the question. We chose the question texture according to character and our game plan. Then we made a quad component for the question. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. Then we had to resize the question. Before resize the question, we had to keep lots of things in our mind. The alphabet should not

cover the background and character. So we had put 59 in X axes, 11 in Y axes and 1 in Z axes so the children see it properly. We had to fix the position of the question. We had to put it in the upper side of the character so that we can get enough space to put three options for the question.

For giving three options for the question, we made three texture of the button in Bengali along with cartoon and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. Then we put a code in C# to go the next level if the children give the correct answer, unless the children will be on the same level. If anyone does not want to play the game, s/he can press the escape button to quit the game.

We had to add two audio for this level. One is the soft background music and another is the question. For that we had to import the music and the audio that we wanted to add into Unity Game Engine. Then we had to make two empty game objects and then save the audios into it.

The way we made the level “yes”, we had to make 11 more levels. In each level we asked different question along with different character, options and background. The audio for question has been added according to the question in each level.

4.6.4 Benefits of Playing“Let’s Play with Doreamon and Mario”

This game can be categorized as puzzle for the autistic kids. Through this game children will learn the name of the color and match the object with the color they recognize. By the end of the game they will be able to recognize color, object name and the alphabets that need to write the name of the colors. They will be able to spell out color names in Bengali.

There are several difficult tasks to perform in the game that will benefit them in several ways. The first task is to listen to the question. As mentioned before autistic child tends to lose concentration or because of the sensory integration issues they fall out from the sense of listening. It can also possible that their brain is unable to process the hearing sense due to their

disability. Hearing them over and over will help them connect their brain response function with hearing senses.

Secondly they have to find the object of the question from different pictures of the screen. Mili, the character uses the object bag, dress etc. Using the eyes and looking for the specified object help the children to deal with their eye contact issue and depth perceptible issues. From this they get confidence to make eye contact in social gatherings and with their peers during play.

In addition, they have to dig into their memory lane to recognize the color of the object and identify the color. In this case they are using their previous memory with present circumstances to get the correct answer. This kind of collaboration helps them to develop their sensory traits.

During the game they get to introduced to an animated character. They become familiar with the character and thus start their imagination. Research shows that autism comes with lack of imagination power as their memory can't visualize on their own. Introducing a colorful a cheerful character gives them an opportunity to visualize and create own imagination scenario. The more they become comfortable with their imagination screen play the more they will be able encounter social environment with confidence.

The game can also be played with their peer. In this way they will take turns of answering the question. Thus they will create a join play attributes which will bring the autistic children outside from their own lonely bubble.

The colors and repetitive question will allow them to concentrate and keep their attention towards the game. Hence they will learn the ability to hold attention and decrease the intensity of PDD syndrome. They will also learn that wrong answer will stop them from getting the new question and hence finishing the level. This way they acquire the habit of patience.

To conclude, through this game they are getting the benefit of memory refresh, overcoming PDD syndrome and learning to use imagination with new animated cartoon.

Some pictures of this game are given below:



Fig 4.6.4(a): pictures of “Let’s Play with Mili”



Fig 4.6.4(b): pictures of “Let’s Play with Mili”



Fig 4.6.4(c): pictures of “Let’s Play with Mili”



Fig 4.6.4(d): pictures of “Let’s Play with Mili”

4.7 Game VII: Let’s Know about Body parts with Opu

4.7.1 Purpose of Making “Let’s Know about Body parts with Opu”

Autism spectrum disorder (ASD) is a complex developmental disability; signs typically appear during early childhood and affect a person's ability to communicate, and interact with others. ASD is defined by a certain set of behaviors and is a "spectrum condition" that affects individuals differently and to varying degrees. There is no known single cause of autism, but increased awareness and early diagnosis and access to appropriate supports lead to significantly improved outcomes.

There have been a number of reports over the past years that express concern about whether or not children with autism should play video games. These studies have indicated that children on the autism spectrum tend to become overly-engaged in video game play and sometimes display other problematic behaviors, such as inattention or obsession particularly with role-playing games. While these studies suggest caution and effective limit-setting on video game play for children with autism, there is much proof that playing video games can be extremely beneficial for children with mild symptoms of autism. Proper care and communication can help to improve the condition of Special children.

The name of this game is "Let's know about body parts with Opu". We have another body parts knowing game. In that game there is animated cartoon character which will help to know the different body parts with rhymes. But in this part they came to learn about the body parts and their work. This game has significant effect on the children. It will help them to increase concentration. Our main purpose of making this game is to help them in learning about the body parts with amusements.

ASD syndrome often comes with concentration deficiency. Children often get distracted and easily loss interest on what they are doing. So we have made this game in a way so that they never get bored.

4.7.2 Game plan

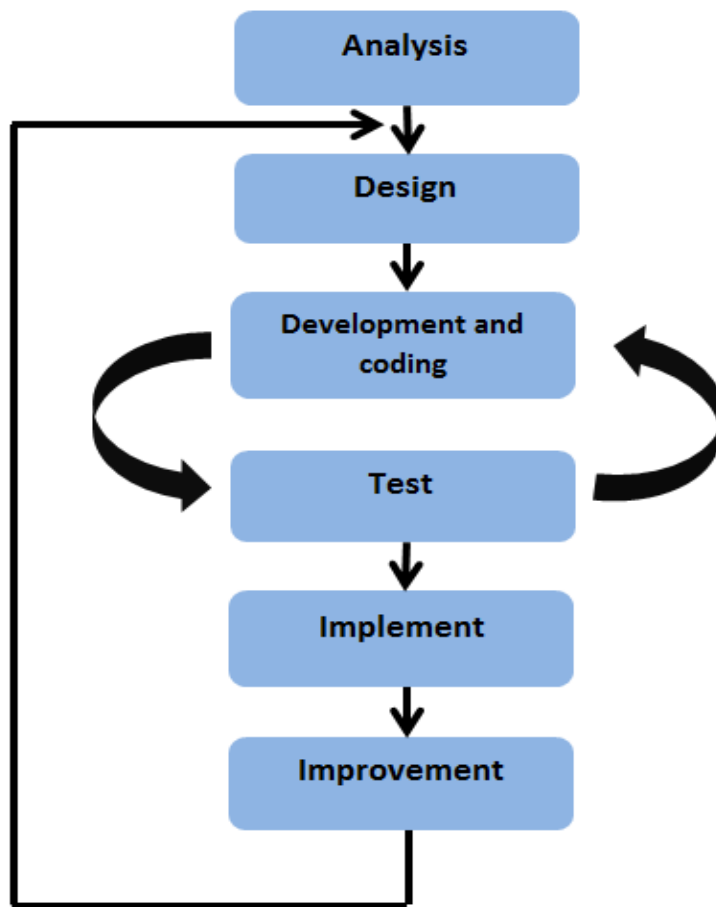


Fig 4.7.2 game plan of “Let’s know about body parts with Opu”

For making the game efficient and interesting, planning plays a very important role. As part of the better planning of the game we went to PROYASH over and over again just to analyze the behavior of the children’s. We have been visiting the organization and interacting with them. From there we came to know the children like color things, music, rhymes, cartoons etc. Interesting things will make the game enjoyable for them and they will play it all the more frequently. So at first by going there we get the thoughts of the examples of the games. Dissecting their conduct really is the most essential piece of the arrangement on the grounds that we have the capacity to think about their likings and what interests them most. We came to realize that they cherish the utilization of color and cartoon characters are all that much natural to them so putting these things on the amusement will make the game all the more enjoyable. By going there we came to learn about different types of Autism. So everyone has different choices. So we

design this game in such a way so that they can able to learn the body parts with amusement. We have monitor that is there any difficulties in this game. If we found anything that is not an easy task for them then we redesign the game again. Most of the children like rhymes. So we have planned to add so many rhymes in our games. Animated cartoons are their favorite. We added animated cartoon character, animated bird, butterfly to attract them.They don't care for exhausting stuffs. So to make the game additionally interesting we have planned to add music to this game. We in the long run chose to make them play the game for sixteen weeks and that would be sufficient for them to realize those rhymes. Further we chose what number of kids we would be able to need to play this game and we assumed control more than ten children to play the game for sixteen week. We chose to take just ten children in light of the fact that we needed to see the genuine results that the amount of this serves to learn by this specific game. We had developed this game to help them in learning. Everything we added according to their choice so that they could find they game interesting.Testing is very important part of game development process.After the game has been legitimately made we our-self played the game several times before offering them to play. We guaranteed the ease of the amusement again and again so that they won't confront any troubles. After quite a bit of affirmation we made the game play by other normal children. After finishing our test we game them to play. Amazingly they liked the game.They were so happy to see such a colorful interface and the music.The liked the animated character a lot. We had implemented the game on 10 children for four months. We got outstanding progress after four months.

4.7.3 Game detail

The name of this game is “playing with Opu”. This is a body parts knowing game. Earlier we have mentioned we have another body parts knowing game. But we have redesigned this game in a different to make an easier way of learning. In this game there are total 29 levels. First level is for introducing with the game. This is the starting page. In the second level Opu will introduce us with him. In the third level Opu will tell us a rhyme. In the next level we put a question about that rhyme. The level is also containing three options. From these three options the children has to choose the correct answer. We have made this game in a way so that if they put wrong answer

then the level won't change to the next level. Only if when the answer is correct then the level will change. So we had to program in that way. After giving the right answer the level will change. The next level there is a cartoon that is waiting to appreciate when they gave the right answer and will ask to go for the next level. In the letter parts we have added so many questions. That is the procedure of playing of the game.

So now let's know about the making of the game. In the first level there is colorful background with cartoon as they like much color we tried to make the game much colorful. So first of all we open Unity Game Engine for this project. We had to open a new scene for each and every level. We added a quad as an object. This quad was our background. We gave texture to it. We could give any texture to this quad as we want. In this background we have added the name of this game. As we made the games in Bengali so we had to add the entire subtitle in Bengali language. We had to make the name of the game in Bengali. Then we import it to Unity Game Engine. There is an audio as well with the subtitle. For this audio he had to record it first. Then we converted to unity supported format and imported to the game engine. We had fixed some internal settings then we could add the audio with the subtitle. In this first level we added little bit animation here. We added a quad as an object. We import a butterfly and added animation with this. To add animation we go to the component and from this we added animation. We had to add curve of animation. Then we had use code to run the animation. After adding all those things we have saved the animation and added it with the butterfly. We added two buttons here. One is for the start of game and another is for exit. We made these two button using NGUI. For making the buttons first of all we imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. We had to add button message legacy. We have used different codes for these two buttons. There is code with start button to change to the next level. Another code we used with stop button to stop the game by pressing this button. The programming language we have used in this game is C#. In the next level Opu will introduce with him. Opu is the cartoon character of this game. So we had to add this character. We had to open a new scene for this level. We added a quad as an object. This quad was our background. We gave texture to it. We

could give any texture to this quad as we want. We added many things in this level. We added tree, bird, butterfly and the cartoon character. We had to add several quads for different object. We import a butterfly and added animation with this. To add animation we go to the component and from this we added animation. We had to add curve of animation. Then we had use code to run the animation. After adding all those things we have saved the animation and added it with the butterfly. We added animation with bird in this same procedure. We had to made the cartoon character by own. Then we import to the game engine. We had to add animation with the help of code written in C# language. We added two buttons here. One is for the start of game and another is for exit. We made these two button using NGUI. For making the buttons first of all we imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. We had to add button message legacy. We have used different codes for these two buttons. There is code with start button to change to the next level. Another code we used with stop button to stop the game by pressing this button. The programming language we have used in this game is C#. There is an audio as well with the subtitle. For this audio he had to record it first. Then we converted to unity supported format and imported to the game engine. We had fixed some internal settings then we could add the audio with the subtitle. In the next level the cartoon will say a rhyme. We had to open a new scene for this level. We added a quad as an object. This quad was our background. We gave texture to it. We could give any texture to this quad as we want. We added many things in this level. We added tree, bird, butterfly and the cartoon character. We had to add several quads for different object. We import a butterfly and added animation with this. To add animation we go to the component and from this we added animation. We had to add curve of animation. Then we had use code to run the animation. After adding all those things we have saved the animation and added it with the butterfly. We added animation with bird in this same procedure. We had to made the cartoon character by own. Then we import to the game engine. We had to add animation with the help of code written in C# language. We added two buttons here. One is for the start of game and another is for exit. We made these two button using NGUI. For making the buttons first of all we imported NGUI into

Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. We had to add button message legacy. We have used different codes for these two buttons. There is code with start button to change to the next level. Another code we used with stop button to stop the game by pressing this button. There is an audio for the rhyme with the subtitle. For this audio he had to record it first. Then we converted to unity supported format and imported to the game engine. We had fixed some internal settings then we could add the audio with the subtitle. In the next level the cartoon character will ask the question about the body part which related with the rhyme. We added a quad as an object. This quad was our background. We gave texture to it. We could give any texture to this quad as we want. We added many things in this level. We added tree, bird, butterfly and the cartoon character. We had to add several quads for different object. We import a butterfly and added animation with this. To add animation we go to the component and from this we added animation. We had to add curve of animation. Then we had use code to run the animation. After adding all those things we have saved the animation and added it with the butterfly. There is an audio for the question with the subtitle. For this audio he had to record it first. Then we converted to unity supported format and imported to the game engine. We had fixed some internal settings then we could add the audio with the subtitle. There are four buttons in this level. One button is for exit and other three buttons are for the option of the question. All the buttons we made the use of NGUI and in the same way as we have mentioned earlier. We have used different codes for different buttons. We had to fixed anchor so the button will not get scatter. The level will change if and only if we press on the correct answer. Otherwise the level won't change. After pressing the correct answer we will go to the next level and there will be a cartoon which will appreciate and ask to go for the next level. The rest of the levels were made by the same procedure.

4.7.4 Benefit of Playing “Let’s know about body parts with Opu”

This has noteworthy impact on the children. It helped them to expand fixation. Yet, we see huge changes on adaptability of development. First part is about knowing body parts with animated cartoon character which will ask question about different body parts. But in this part they came to learn about the body parts and their work. This game has significant effect on the children. It helped them to increase concentration. But we notice significant changes on flexibility of movement. We know there is some group of autistic children who cannot move their hands properly. We are introducing body parts with work in this game. When the cartoon character introduces hands it moves his hands. We notice that the children are also moving thing their hands, blink their eyes, pointing to the ear. So this game helped them to increase the flexibility of movement.

Some pictures of this game are given below:



Fig 4.7.4(a): Pictures of Let's Know about Body parts with Opu"



Fig 4.7.4(b): Pictures of Let's Know about Body parts with OPU”:



Fig 4.7.4(c): Pictures of Let's Know about Body parts with OPU”:



Fig 4.7.4(d): Pictures of Let's Know about Body parts with OPU”:

4.8Game VIII: Wish Book

4.8.1 Purpose of Making Wish Book

The main reason of this game is to help of improving communication and verbal skill of the autistic children of Bangladesh.

Autism spectrum disorder (ASD) covers a set of developmental disabilities that can cause significant social, communication, and behavioral challenges. People with ASD process information in their brain differently than other people. While we study about Autism Spectrum Disorder we came to learn there are several kinds of Autism. Children of the same age cannot face the same problem. Their mental development can't be same. One of the major problems they are facing while communicates with others. The word “autism” has its origin in the Greek word “autos,” which means “self.” Children with ASD often are self-absorbed and seem to exist in a private world where they are unable to successfully communicate and interact with others.

Children with ASD may have difficulty developing language skills and understanding what others say to them. They also may have difficulty communicating nonverbally, such as through hand gestures, eye contact, and facial expressions. Not every child with ASD will have a language problem. A children capacity to convey will change, contingent on his or her scholarly and social improvement. A few kids with ASD may be not able to talk. Others may have rich vocabularies and have the capacity to discuss particular subjects in awesome subtle element. Most children with ASD have next to zero issue affirming words. The dominant part, on the other hand, experience issues utilizing dialect adequately, particularly when they converse with other individuals. Many have problems with the meaning and rhythm of words and sentences. They likewise may be not able to comprehend non-verbal communication and the subtleties of vocal tones. [16]

Below are some patterns of language use and behaviors that are often found in children with ASD.

- Repetitive or rigid language
- Narrow interests and exceptional abilities
- Uneven language development
- Poor nonverbal conversation skills

Often, children with ASD who can speak will say things that have no meaning or that seem out of context in conversations with others. Some children with ASD speak in a high-pitched or singsong voice or use robot-like speech. Other children may use stock phrases to start a conversation. Some children may be able to deliver an in-depth monologue about a topic that holds their interest, even though they may not be able to carry on a two-way conversation about the same topic. Many children with ASD develop some speech and language skills, but not to a normal level of ability, and their progress are usually uneven. For example, they may develop a strong vocabulary in a particular area of interest very quickly.

Children with ASD often are unable to use gestures such as pointing to an object to give meaning to their speech. They often avoid eye contact, which can make them seem rude, uninterested, or inattentive. Without meaningful gestures or the language to communicate, many children with ASD become frustrated in their attempts to make their feelings and needs known. They may act out their frustrations through vocal outbursts or other inappropriate behaviors.

Some children with ASD may never develop verbal language skills. For them, the goal may be to acquire gestured communication, such as the use of sign language. For others, the goal may be to communicate by means of a symbol system in which pictures are used to convey thoughts. Symbol systems can range from picture boards or cards to sophisticated electronic devices that generate speech through the use of buttons that represent common items or actions. Some children has verbal problem. They can talk but not in proper way. That is why we have planned to include audio and subtitle. All the Audio and subtitles are in Bengali language. For example if any children want to play they can express by pressing that page containing the picture of playing. There will be button written in Bengali and an audio as well. The audio we have included to improve their verbal communication. When they hear an audio over and over again then there is a high possibility to improve verbal communication. [16]

4.8.2 Game plan

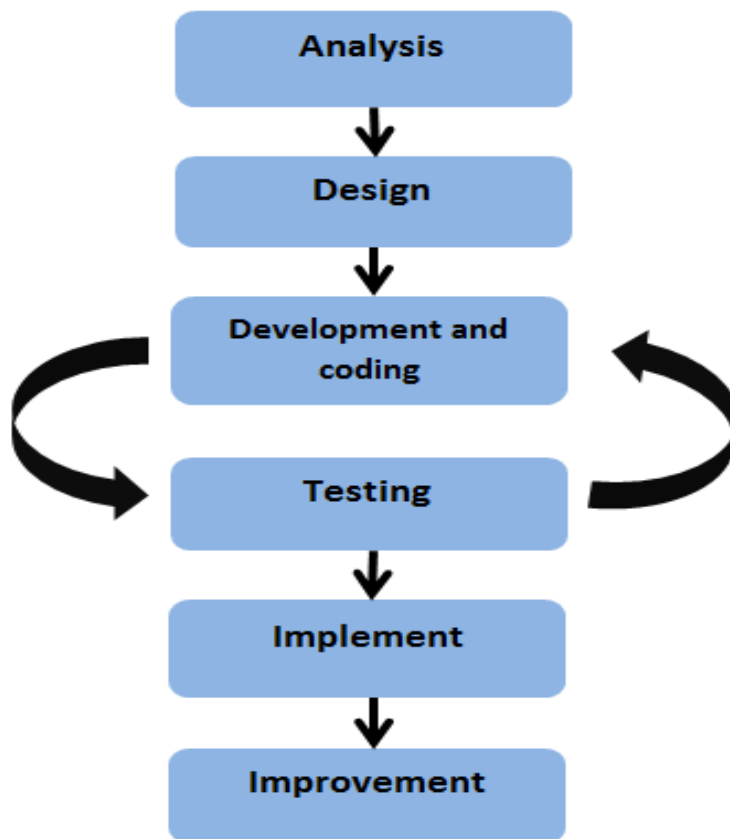


Fig 4.8.2: game plan of “wish book”

To make something perfect planning has significant importance. Analyzing their behavior actually is the most important part of the planning. We have to know their behavior, likings and disliking. First of all we went to PROYASH to analyze the behavior of the children. For about four months we have been visiting the organization PROYASH we interact with them. From there we came to know the children likes color, music rhymes etc. While interacting with special children we found some children are very aggressive. At that time they don't listen to anyone. Surprisingly we found the same problem in every school. The teachers said to us that the reason of that aggression is communication problem. Teachers are not getting what are the children wants to say. While they fail to make other understand whatever they want then they become frustrated. And their aggression comes from there. As we mentioned earlier we went to

PROYASH. We went there to interact with the children and to understand their behavior. The principle of that organization suggested us to develop this kind of game so that they would communicate through this game. We have designed this game according to their requirements. The special children has special attitude for music. Some children cannot talk but they have attraction on music. Music helps them to release anxiety and stress. Music also increases attention and improve eye contact. [17]

So we have planned to include relaxing background music to this game. Our game has been designed in that way so that the children can play it easily and find interesting. The development process is very important. We develop this game for Autistic children. So we have to include everything according to their choice. We develop this game in a way so that they can able to play easily. One of the very important parts of game development is testing. After the game has been legitimately made we our-self played the game several times before offering them to play. We guaranteed the ease of the amusement again and again so that they won't confront any troubles. After quite a bit of affirmation we made the game play by other normal kids. After finishing our test we game them to play. Amazingly they liked the game .The were so happy to see such a colorful interface and the music. We had implemented the game on 10 children for four months and the result was outstanding with a great progress rate over the times.

4.8.3 Game Detail

We have developed all the games in Unity game engine. The interface of this game is like a book. There are several pages of this book. So we gave the name of our book is “Wish Book”. We have made this game on unity game engine. For every page we have made different level. There are 10 levels of this game. First level is containing the front page of the book. this page has a start button. To make the front page of this game we had to open a new scene in Unity Game Engine. We took a quad as game object and gave texture to it. We had to make a new material where we saved the texture that we want to give and then put the material to in the component. By doing it, we got our desired texture. We added colorful background to attract them. For each level we had open a new scene. The game starts by pressing this button. There is

another stop button as well. The game will stop by pressing this button. We made these two buttons using NGUI. For making the buttons first of all we imported NGUI into Unity Game Engine. Then we imported all the libraries into it. Then we made a texture of the button in Bengali and imported it into Unity Game Engine. Then we had to make a sprite and update the atlas to put the texture into the sprite. Then we fixed up the position of the button. We had to give anchors in it so we can fix in the scene where we want to put the button. Then we attach button script and collider to make it a button properly. We had to add button message legacy. We have used different codes for these two buttons. There is code with start button to change to the next level. Another code we used with stop button to stop the game by pressing this button. The programming we have used in this game language is C#. Next level is level 1. This level the background contains picture of playing so that the children can express if they want to play at that moment. There is background music and audio with this level. There is background music and audio with this level. First of all we had to choose a music which we wanted to include. Then we had to convert it to Unity Game Engine supported format. Then we could import that music into Unity. Then we had to add that music with background. All the audios are in Bengali language. There are 11 audio in the entire game. First of all we had to record the audio then we converted to unity supported format. Then we added the audio to the level 1. There are three buttons in this level. We made these buttons using NGUI. One is containing the subtitle of that audio we have added. One is for Exit and another is for change to the next level. There are two different codes as well one for exit and another for changing the current level. The programming language we have used for these two buttons is C#. Next level is level 2. This level the background contains picture of playing football so that the children can express if they want to play at that moment. There is background music and audio with this level. First of all we had to choose a music which we wanted to include. Then we had to convert it to Unity Game Engine supported format. Then we could import that music into Unity. Then we had to add that music with background. All the audios are in Bengali language. First of all we had to record the audio then we converted to unity supported format. Then we added the audio to the level 2. There are four buttons in this level. We made these buttons using NGUI. One is containing the subtitle of that audio we have added. One is for Exit, one for change the current level to previous level another is for change to the next level. There are three different codes as well one for exit and another for changing the current level. The programming language we have used for these two

buttons is C#. The other levels are developed by the same procedure. After making of all the levels we had built the project. We went to build and settings then we had to add all the levels with our desire sequence.

4.8.4 Benefits of playing “Wish Book”

The vast majority of the special child confronts correspondence issue. So we attempted that they could speak with others appropriately. This game is basically for communication. This game is made for helping them to communicate with people. The children who cannot talk properly, they liked this game most as it helped them to express what they wanted to say to others. This game was suggested by PROYASH. Initially the children were not interested to see this game. But when they could realize that they are able to express their feeling through this game they started liking this game. Our motive was to restrain their aggressiveness and amazingly we have succeeded.

Some pictures of this game are given below:



Fig 4.8.4(a): pictures of “wish book”



Fig 4.8.4(b): pictures of “wish book”



Fig 4.8.4(c): pictures of “wish book”



Fig 4.8.4(d): pictures of “wish book”

CHAPTER 5

EXPERIMENTAL RESULT

We have been visiting PROYASH for around four months. PROYASH, an organization for autistic children extended a higher level of help by the means of technology. We came up with the thought of designing interactive Bengali games for these children that would help them to know and understand through games.

We started our experimental work with the children of this organization. For about 4 months we have been visiting the organization, interacting with the children, understanding them. The organization has a learning environment which increased the potential of the children to learn through games. In these last few months we have been testing the games with the children so that

we could understand their sectors of interest and the amendments required from our side. The tests had been successful over times thus leading us to complete our session of work.

We gave all the games to “PROYASH”. We went there and have installed the games to their labs. Surprisingly they have liked our games much. They were very interested to play the games. Our target children are those who are at the age of 8-10. We took 4 or 5 children from each class. Every day the teachers of PROYASH took them to the lab to play the games. Every week we went there to monitor the improvement. The teachers of “PROYASH” helped those children who were not able to play the games by own. For the result we have selected 10 students. We worked with PROYASH for 16 weeks. In these 16 weeks we spent time with them and noted down the result. The experimental results of the games are given below:

5.1 Magic Coins

The name of our first game is “Magic Coins”. At the first week we did not notice that much improvement. As the children are mentally challenged they needed much time to learn rather than normal child. At the second week we did not notice that much improvement than the first week. The special children has problem with concentration. That is why we needed little bit time to get our expected result. At the third week they found some interest to play. They attracted much by the background music and rhymes. At the fourth week they gave more attention to the game. When we have played the game they have paid the full attention. In the fifth week we did not notice much improvement. Because in that week the teachers could not find much time to play because of their regular activities. In the sixth week they started telling some part the rhymes that we have used in our game. Some of children could capture some alphabets. At the seventh week we have noticed they could capture many alphabets. In the week of eight the outcome was not that much. In the nine week the result remained same. But at the end of week thirteen we got unbelievable improvement. At the middle of fifteen and sixteen week we have seen most of the children can play the game without the help of others. They have learned most of the alphabets with the rhymes.

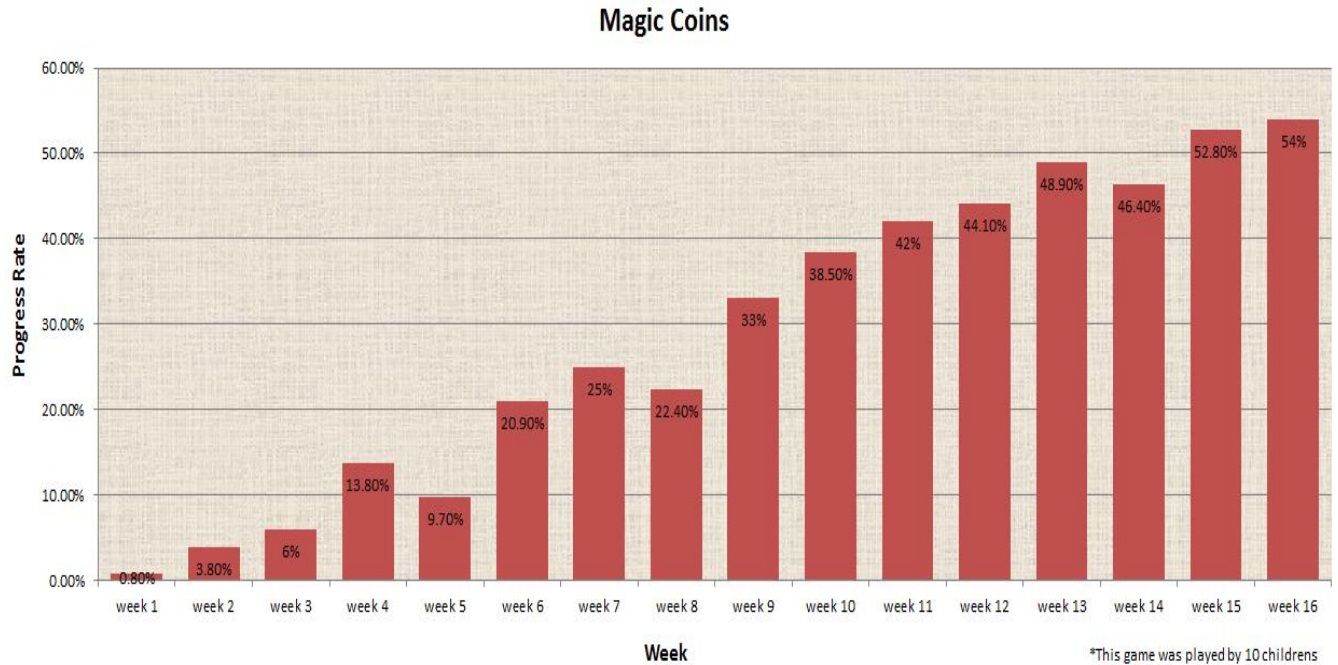


Fig 5.1: Result of Magic Coins

5.2 Ride in Aero plane

The second game is called “Ride in Aero plane”. At the beginning we did not found expected result. At the first week they just watched the game. They liked the animation and music. At the second week some students showed interest. They have tried to play the game. In the week of three they tried the game with the help of others. We all know they have problem with movements. They cannot move their hands properly. So within this fourth week there was no improvement. Fourth to nine weeks we had to make the understand how to move the hands. After nine week they could play alone. At the tenth week we have noticed their hand movements improved a lot than before. After twelve weeks we have seen their hand movements become more perfect

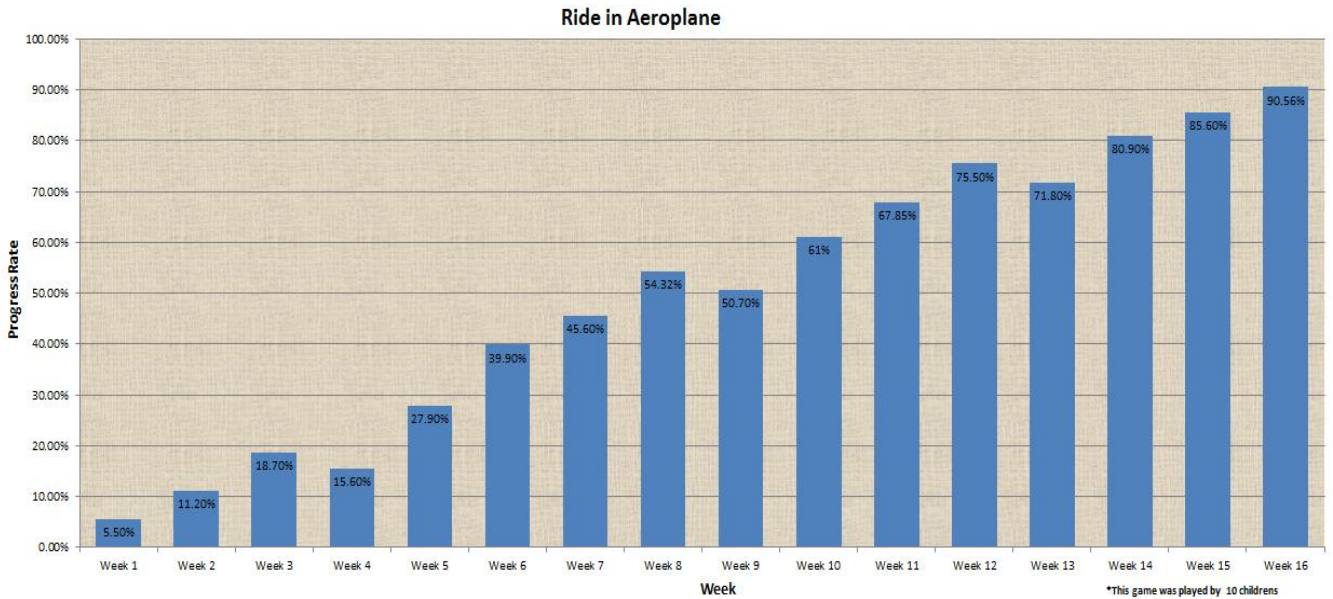


Fig 5.2: Result of Ride in Aeroplane

5.3 Body parts rhymes

This game is called “Body parts rhymes”. We have seen they were very interested to play this game from the first week. From the second week they have paid attention. They have liked the animated character. At the third week we saw that they are playing the game with amusement. At the four and fifth week we have not seen that much improvement. Because it is quite difficult grab their attention every time. The end of the eight week they improved lot. When we played the game they started pointing to their body parts with the cartoon character. In the eleventh week we have seen they already know the rhymes and after fourteenth week they came to know all the body parts perfectly.

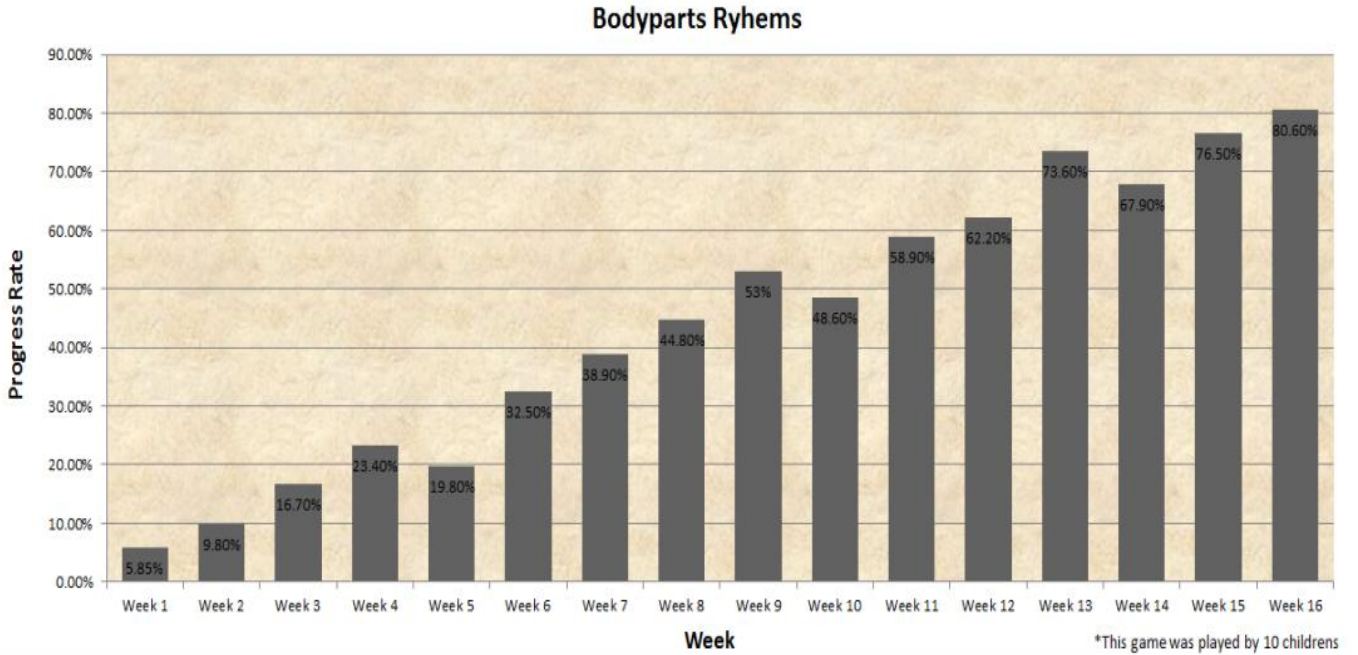


Fig 5.3: Result of BodypartsRyhems

5.4 World of colors

The fourth one is called “World of Colors”. At the first week they just watched the game. They liked animation and music. At the second week some students showed interest. They have tried to play the game. In the week of three they tried the game with the help of others. We have seen they were very interested to play this game from the fourth week. From the second week they have paid attention. From the fifth week they started talking with the character. After nine week we saw that they are trying introducing color with others. They liked this game so much. That is why we got our expected result after few weeks.

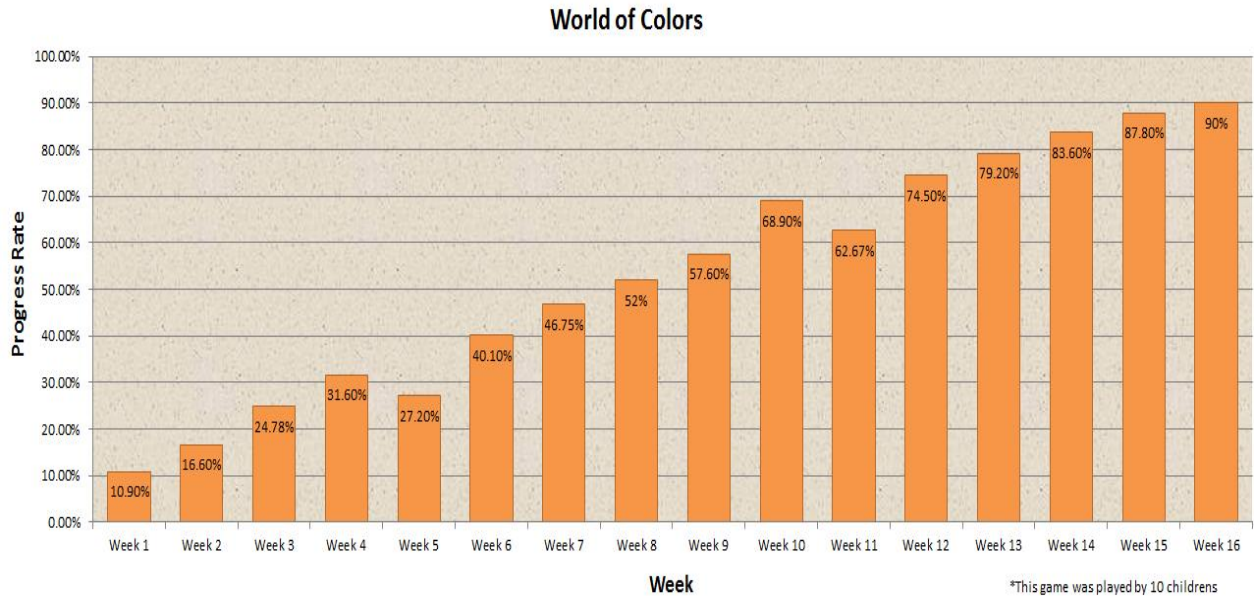


Fig 5.4: Result of World of Colors

5.5 Play with Doreamon and Mario

The fifth game is called “Play with Doreamon and Mario”. First few weeks they only saw the game. They liked the animated cartoon Doreamon and Mario. After four week they got interest with this game. In the fifth and sixth week they played the game. At the end of week eight they could learn only left and right. As their mental development is not like other normal child they needed much time to learn. We know autism is not same for all children. So every child could not learn the same thing with the same time. That is why at the end of week sixteen some children could learn all the direction.

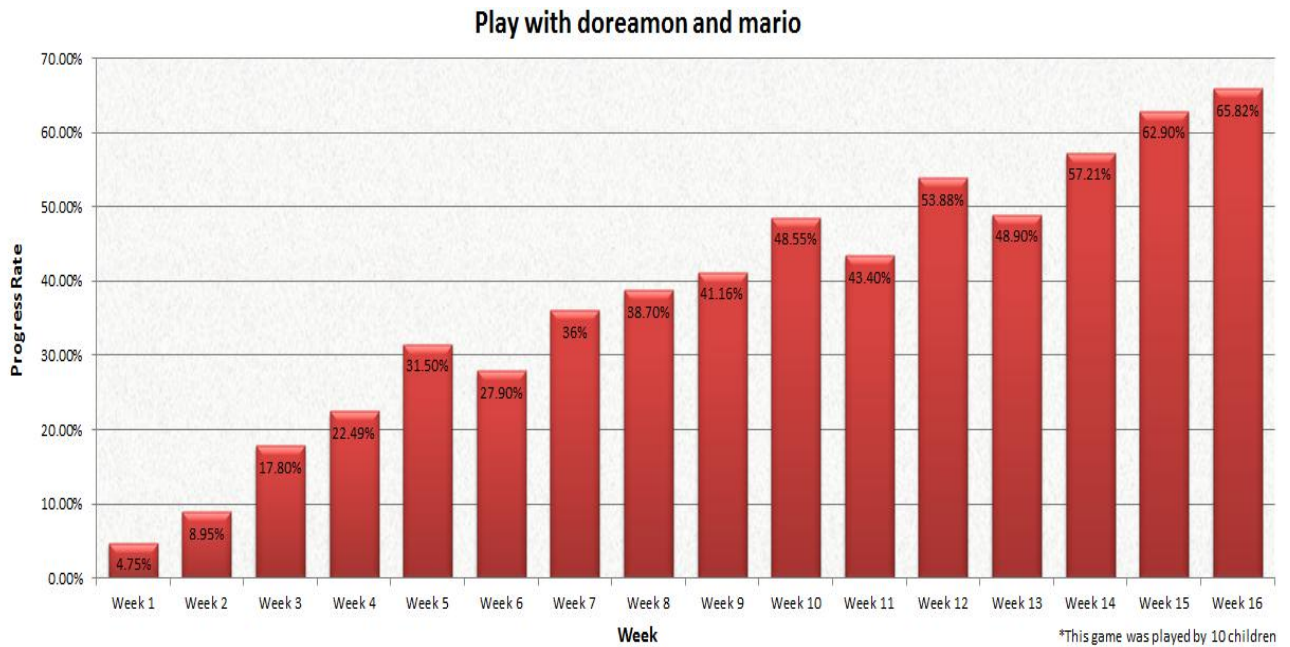


Fig 5.5: Result of Play with Doreamon and Mario

5.6 Let's Play with Mili

The sixth game is called name “Let’s Play with Mili”. At the first week they just watched the game. They liked animation and music. At the second week some students showed interest. They have tried to play the game. In the week of three they tried the game with the help of others. We have seen they were very interested to play this game from the fourth week. From the second week they have paid attention. From the fifth week they started talking with the character. After nine week we saw that they are trying introducing color with others. They liked this game so much. That is why we got our expected result after few weeks. After thirteenth week they came to learn all the colors.

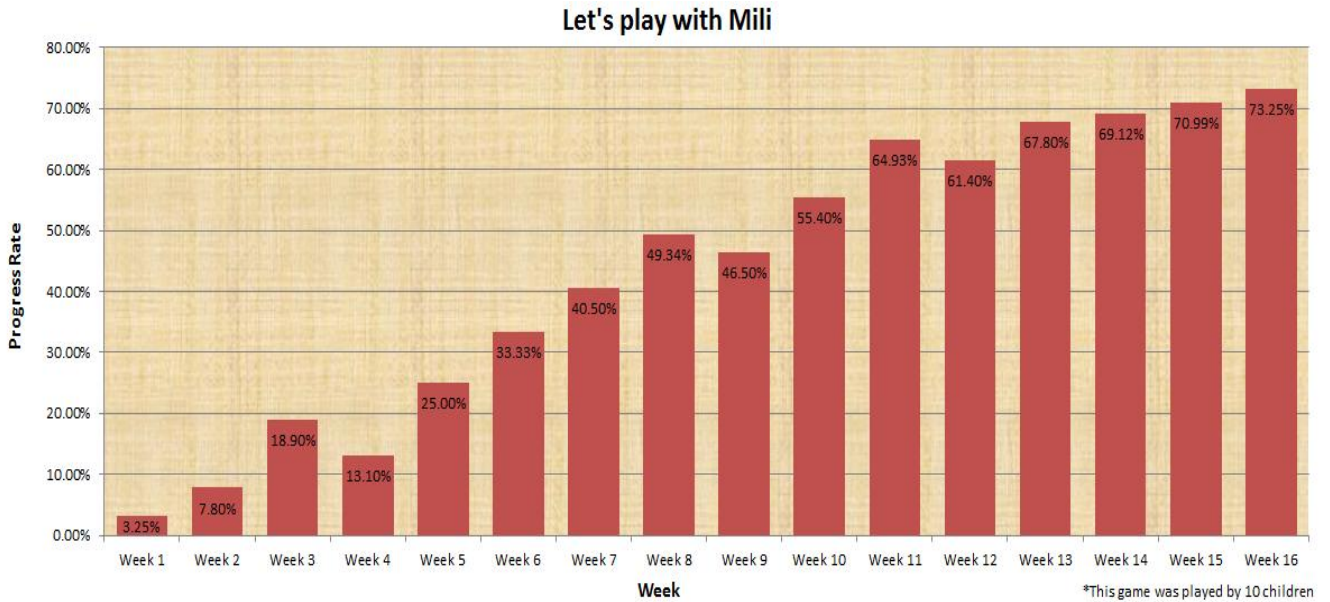


Fig 5.6: Result of Lets play with Mili

5.7 Let’s know about Body parts with Opu

The game which is number seventh is called “Let’s know about Body parts with Opu”. We have seen they were very interested to play this game from the first week. From the second week they have paid attention. They have liked the animated character. At the third week we saw that they are playing the game with amusement. At the four and fifth week we have not seen that much improvement because it is quite difficult to grab their attention every time. The end of the eight week they improved a lot. When we played the game they started pointing to their body parts with the cartoon character. In the eleventh week we have seen they already know the rhymes and after fourteenth week they came to know all the body parts perfectly.

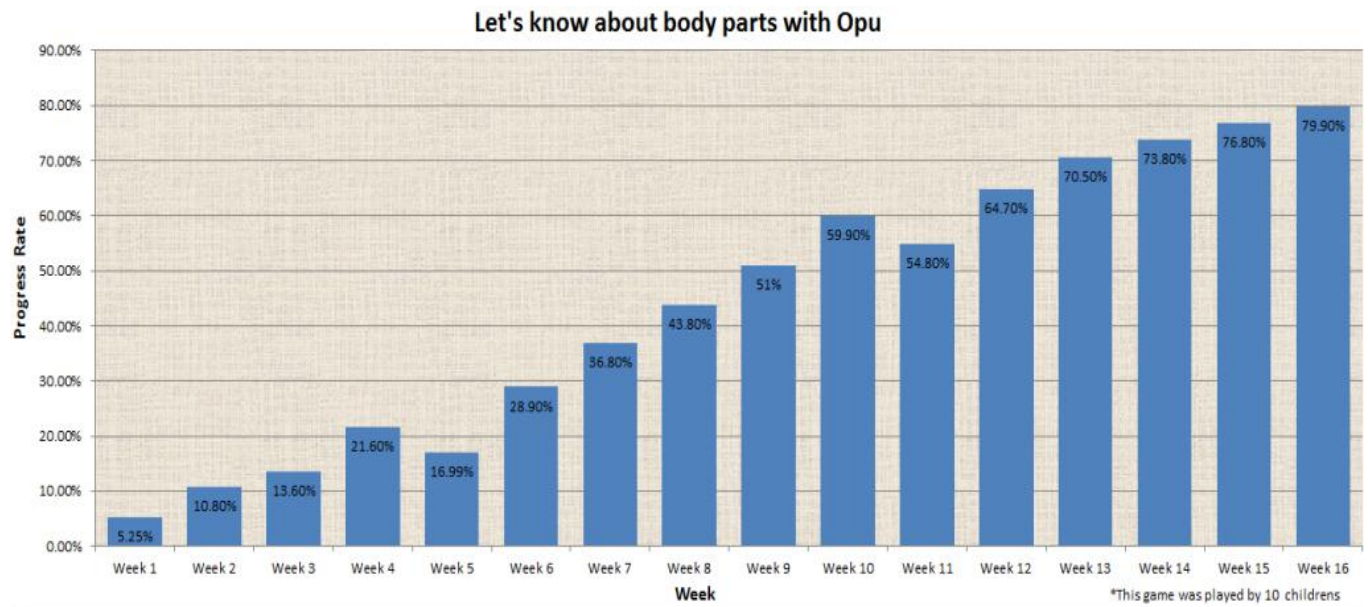


Fig 5.7: Result of Lets know about body parts with Opu

5.8 Wish Book

The eighth game is called “Wish Book”. The first week they were not interested to see the game. We made this game for extremely introvert children. They don’t want to talk with anyone. So we have found difficulties communicate with them. In the second, third and fourth week we just tried to make them understand about the game. After fifth week they showed interest on this. At the seventh week some children understood that game. In ninth week they started expressing through this game. But after nine week there was not that much improvement. In the twelfth week surprisingly some children started talk a little bit. After fifteenth week some children who were extremely aggressive they become more quite than before.

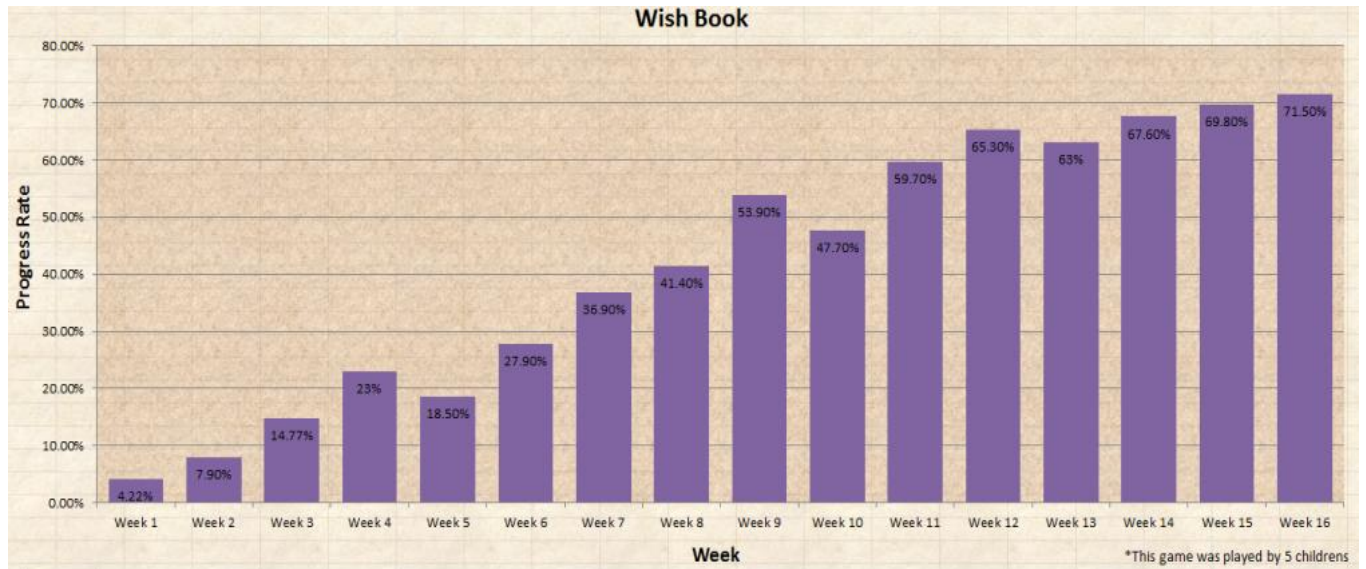


Fig 5.8: Result of Wish Book

The games are created mainly to understand the basic stuff that these children need to know. We have been researching well enough to develop these games and now we are happy to say that our interactive games are working in proper manner and this form of helping to understand by the means of technology for the special children would go a long way. Our start with games is hopefully on rise with more other sectors we look forward to work on in later future.

CHAPTER 6

BEHAVIORAL IMPACT OF THE SPECIAL CHILDREN

We gave our all game to PROYASH so that the children can play it and we can measure the improvement. The improvements are given below for each of the games:

6.1 Magic Coins

Our first game is “Magic Coins”. With the help of this games, they became very interested about the knowing the alphabet. Usually they used to know alphabets through either reading books or hearing rhythms from the teachers and parents. Through this game they came to see some interesting things with the alphabets. They can even hear the rhythms. We appreciated when they could collect a coin and it motivated them to move forward. At the first few weeks we did not notice that much improvement. As the children are mentally challenged the needed much time to learn rather than normal child. But after ten weeks we noticed huge improvement. We witnessed the great improvement and it happened because of the familiar rhymes that has been used in the games are similar as they had been taught in their school verbally. Because of the cartoon background texture and lot variation of colors they were very much interested to play the game over and again. Overcoming the obstacle and coming through to a next alphabet was the main source of interest to them. They were coming thorough to the alphabets and because of the obstacles in many points of the game they had been dropped resulting into play the game over and over just to finish the entire game and by playing for frequent times they were able to learn the alphabets along with the rhymes. This game was very much user friendly for them and that is why it was very easy for them to play the game more often and learn the alphabets along with the rhymes through an easier manner.

6.2 Ride in Aero plane

The second game is called “Ride in Aero plane”. This game is made for helping them to improve their hand movement and eye contact. As this game will be played with leap motion, they can see where the object is going with their movement. They need to see into the screen while playing this game and it helps them to improve their eye contact. They often do not look at people when they are talking. This game is made with high animation enrichment so that they

feel more interested to play the game. While they are riding the plane with the leap motion device, at the back ground of the game there are sky, clouds, sun, birds and kite. It makes them feel that they are in the sky and they are riding the plane by themselves. This special kind of children loves the moving objects as they can maintain it by their own. So this game gave them a glimpse of sky and riding a plane by themselves resulting in playing the game at daily bases. While they are riding the plane they are actually doing an exercise for them by moving their hands left to right and up down. It also makes them to look at the plane and the background for a long period of time and it improves their stability of looking to something straightly. There was also a background sound on the game to make the game more appealing. So the lively background of the game and doing something by them makes them very much interested to play the game and by playing improving their hand textures and eye contacts. Through this game it's being practiced. This game has significant benefit. This game helped them to improve-

- Imitation skill
- Hand movement
- Eye hand coordination
- Eye contact
- Attention to any object
- Depth perception
- Concentration

At the beginning we did not found expected result. After seven or eight weeks we have seen the improvement as we expected.

6.3 World of Colors

The third one is called “World of Colors”. By playing this game they came to know about lots of colors. Earlier they used to know about only some few colors. They used to hear only the name of the colors, but through this game they can see the examples. They played it with interest as they were able to see and hear everything about what they are learning. We include animated cartoon character and music and they liked this game much. That is why a significant

improvement seen after one week. For the first few weeks they were able to recognize the colors wherever they sees the colors and in the last final weeks they were able to memorizes the colors along with the objects that they see in the game. In the game with each of the color we have placed three things, the color, two objects containing the color and one rhyme so that it makes them memories one after another like a cycle. The objects were the main part of their interest and for learning and remembering the audio plays the important part. So in this game both the visualizing and hearing part was there making them more enthusiastic because when they are listening to the rhymes along with the object before their eyes, it makes them to remember that thing easily.

6.4 Body parts rhymes

The fourth game is called “Body parts rhymes”. It is a game with rhymes. In this game, there is an animated character which helping them to teach about body part with some rhymes. By playing this game children came to learn about the body parts and different rhymes. Study is always boring for them. They cannot pay attention for a long time. But amazing thing is all the children are very excited to play this game. Now they know all the body parts. When the game starts they started talking with the cartoon character. This game helps them to increase attention. Another amazing thing is those children who does not wanted to talk or hardly talk they are also liking this game. The cartoon character of this game makes the game more interesting. In this game all the body parts were described with that cartoon character and when they are seeing the characters they are able to resemble the same body parts with their own. So it makes the game more interesting for them that they have the same body parts as the cartoon character have. They think the cartoon character one of them and they try to imitate him which makes them familiarresulting in playing the game over and over and learning and memorizing all the body parts through it. We got the result after seven week when they were able to recognize the body parts easily. In the final weeks they were able to memories all the body parts of their own body and they could tell about their other mates body parts as well.

6.5 Play with Doreamon and Mario

The fifth game is called “Play with Doreamon and Mario”. By playing this game they came to know about the direction. Generally it is hard to learn the direction properly for the children. We tried to develop that game in a way so that they come to know about directions. As we added pictures and subtitle it become easier to visualize with those pictures. We have added in total eight directions that will make their daily necessity easier. We structured all the directions in a way so that it goes in their mind straightly. For example all direction has been repeated three time so that they could memorize the directions easily and after the directions has been describes to them we have tested that if they are able to learn them or not. We asked them immediately about the direction that was shown in the previous stage. And once they are able to answer that then they are allowed to move toward the next stage. So in this way, we make the game a bit more educative so that it helps them to learn. This game has highly learning component and the directions are made with full of colors and cartoon characters. Doremon in a very popular cartoon character among the children that’s whyat the background of the game we placed Doremon cartoon to make the game a bit interesting to the. As all the directions were made of different colors so it helps them to learn the direction by using that colors resulting in memorizing both the directions and colors. At the very beginning it was little bit hard for them to remember all the colors. .But after playing this game we notice significant improvement of them. Now they are known with the direction. They can differentiate which is left which is right side.

6.6 Let’s play with Mili

The sixth game is called name “Let’s play with Mili”. It is based on helping them about knowing about color but in a different way. In this part of the project there is a game for recognizing different color with different thing. So they are now familiar with so many color and different things of that particular color. This game helps to improve eye contact as well as concentration. This game is basically the furthestmost version of the second game world of colors. At this level we test the students if they are able to recognize the color or not. In this game we used a female cartoon character who is Mili and by her many activities we are able to test the students. We

have designed the game with many objectives of different colors and then asked the children using Mili about the color of different objects. In every level they are asked about colors related to the character Mili and objects that appears in the screen and if they are able to give the right answers only then they are able to go to the next level. So there are lots learning scope for them in this game as the color and cartoon character of this game has been highly designed with great animation which makes them go through the games over and over until they finish the game and by repeating each level they are able to learn the colors by heart. We have seen our expected result after three week and following of the weeks they are able to recognize all the colors easily.

6.7 Let's know about body parts with Opu

The game which is number seven is called “Let's know about body parts with Opu”. First part is about knowing body parts with animated cartoon character which will ask question about different body parts. But in this part they came to learn about the body parts and their work. This game has significant effect on the children. It helped them to increase concentration. But we notice significant changes on flexibility of movement. We know there is some group of autistic children who cannot move their hands properly. We are introducing body parts with work in this game. When the cartoon character introduces hands it moves his hands. We notice that the children are also moving thing their hands, blink their eyes, pointing to the ear. So this game helped them to increase the flexibility of movement. In this game all the body parts are shown in each of the stages and a small rhyme about body parts were there to make them more interested. In the second game they learn about all the important body parts and in this stage we are testing the students if they are able to answer the question. At the first place we show them the cartoon character with a particular body parts and then we ask them about that part and see if they are able to answer or not. The individual body parts that are shown in the each level are focused with the cartoon character Opu and by the movement of the parts the students get interested resulting in memorizing all the body parts easily. So by the movement of the body parts of the cartoon character Opu the students gets excited and more often they play this game and memories the body parts in a simpler way. Our expected results have seen after six week when they were able to recognize the cartoon character by its name with all the body parts of the character and of themselves along with their mates' body parts.

6.8 Wish Book

The eighth game is called “Wish Book”. This game is made for helping them to communicate with people. The children who cannot talk properly, they liked this game most as it helped them to express what they wanted to say to others. This game was suggested by PROYASH. Initially they were not interested to see this game. But when they could realize that they are able to express their feeling through this game they started liking this game. Our motive was to restrain their aggressiveness and amazingly we have succeeded. Most of the special child faces communication problem. So we tried that they could communicate with others properly. The game was designed with 10 wishes according to their needs and wants. Many of them are not able to talk so this game actually gives them a lot of options to express their feelings. Whatever they feel they are not only able to express by them because some of them can’t even move their hands to point those things they really want. So by this game a lot of options were there for them to express what they want exactly. In this game the most common ten needs of them are included so that it helps them to fulfill their daily necessity by making the teachers understand. And thus the wish book helps these extreme disable children to express their feelings.

CHAPTER 7

FUTURE WORK

We have developed these eight games for the children who are 8-10 years old. Our main focus is to make their daily life a bit easier. So we develop our games in such a way that they can learn easily. The special children have interest on computer, cell phone and other devices. So in future we have planned for developing more games with latest technology. This time we want work for more children who are from 11-15 years. We would like to enrich our games with more animations and effects as they were interested in playing games because of the animation and

effects. One of our games called “Ride in Aero plane” helped them a lot to improve their hand movement where they have to give hand gestures as input. This game works as an effective exercise. So, we would like to make this type of games that would help them in physical development and mental amusement. So we have a plan to develop a game with a Kinect sensor which will help them to move other parts of their body.

Kinect sensor (codenamed in development as Project Natal) is a line of motion sensing input devices by Microsoft. It enables users to control and interact with their console/computer without the need for a game controller, through a natural user interface using gestures and spoken commands.

Kinect sensor can take input from the bones of the whole body parts. So if any children have some severe physical imbalance like walking problems or body movement problems then developing a game with this device will help to improve the whole body movement and gestures. Kinect sensor also works with spoken commands. If we could add this feature with our game then it would be helpful to improve their spoken skill if anyone has verbal problem.

CHAPTER 8

CONCLUSION

8.1 Discussion

Education and communication with autistic children have been a common issue throughout the globe. Although this project was established keeping children of Bangladesh in mind, all these games may be able to tackle similar situations in different parts of the world with different language and subtitle. The autistic children are different from other normal people. They need

special care and support for it. Sometimes their teachers and their parents cannot even help them properly to learn something sometimes. This game will allow them to learn in an easier way. Sometimes they are not able to express their feelings about anything. Through playing all these games over and over again, they will have some improvement in their communication skills. All the available other games are mostly in English. These games will help the Bangladeshi children and this paper is focusing on helping Bangladeshi autistic but all these games are able to help the autistic children of the globe.

It is also possible to see some exceptions adapting the game as not all autism are same. It might not be efficient for some autistic child due to their exceptional ability. It is seen that sometimes autistic children are over talented in a specific area and this game might seem childish to them. On other case it might seem rather impossible to cope with. However, there are possibilities to improve and modify the game accordingly in future if needed. As this was designed keeping in mind the general autistic children, it can be customized for specific autistic children according to their needs by adding more and different challenging games, including more educational stuff like science, history or universe.

8.2 Limitations

The thesis includes the initial works done for the development in education and communication for the special children. Though the games have one limitation that should have been overcome to allow it to reach the level it is aimed for. We implemented the games over the special children for sixteen consecutive weeks. And we got the approximate results from them. But according to the teachers of PROYASH the results would have been more appropriate if we can make them play the games and test them for about one and half of a year Because all the children over there are not of same capabilities so some of them needs more time to learn. That is why, if we could

have given them that much time then we could see the results that how they are implementing their learning in real life.

8.3 Conclusion

In our country we don't have much learning equipment for autistic children. We can use others learning software or applications. Since those are not in Bengali language so, all these games will be able to help them in large scale. These games will make them familiar with Bengali alphabets, colors, surroundings, body parts and help them interact through pictures and motions. While most of the time they were neglected, the rhymes will bright up their spirits and bring positive atmosphere around them. These games not only improve and encourage the autistic child but also inspire their parents and give hope for their child's positive future. These games could bridge them with today's technology and current world. All these games are designed based on the research on the autistic children of Bangladesh. Their choices were the first preference for all these game.

In a developing country like Bangladesh, people did not understand how to deal with the autistic children. Some parents used to treat their children as burden. Things are changing now. Through media and government people now know how to behave with them. But this is not enough for them. Many of the special children do not even get the chance of educations and that's why they remain in the same position. These special children are extremely talented with their point of interest but we cannot make them flourish because of the proper guidance.

There are lots of scopes for them to learn through games. They are very much attracted to the latest technologies and gadgets rather the verbal books and notes. So we have to make them learn through the process they want. There are no games in Bangladesh for the autistic children so if some other games will be made in different patterns of their daily necessity that it will bring a great change for the special children. If the biggest gaming companies come forward to make some innovative game for them, that will create a new window for the children to explore their latent talents. We just have to identify their point of interest and nurture them until they are ready to explore. The biggest NGOs and government can Sponsor this type of games so that we will be

able to make the games better and more user friendly using the latest technology. So all kind of people of different races and religion should come forward to stand with them and ensure them to lead a life like other normal children does.

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