

# Degree Project

## Educational Content for Dyslexic Children

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## 'Lexy'- For Children with Dyslexia

Creating an educational system that makes helps children with dyslexia

# Approval Sheet

The Animation Degree Project which is being done by Keerti Chowdhry, M.Des Animation (136340001) is approved, in partial fulfillment of requirements of the Masters of Design degree in Animation in Industrial Design Centre of Indian Institute of Technology, Bombay.

  
..... Project Guide

  
..... Internal Examiner

  
..... Chair Person

MANISHA  
..... External

# Declaration

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



Signature

Name: Keerti Chowdhry

# Acknowledgement

At first, this project had seemed like an impossible task to me.

It has taken the support and sincerest efforts of several people to help me find my way and materialize this project into fruitful reality. First off, I owe my gratitude to my guide Prof. Nina Sabnani, without whose patient counsel and encouragement, I would've never found the resolution to go on. I'm also thankful to Prof. Ravi Poovaiah and Prof. Sumant Rao for their invaluable feedback and interest shown.

I would like to thank Ms. Manisha Mohan, Ms. Rukshana Sholapurwala, Dr. Sunil Karande, Ms. Anamika for helping me gain valuable insights about the topic at K.E.M. Hospital Learning Disability Center. Also, Ms. Veena Basu, Ms. Namita and Ms. Sheeba at the Verve Centre for their patience, helpfulness and support. I'm grateful my sister Ms. Preeti Chowdhry, for the inspiration to take up this project and without whose immense help and eagerness, I would have been lost.

Also to my parents for constant unquestioning moral support. And lastly I'm thankful to my classmates and peers, without whose feedback, suggestions and motivation, I would have been doddering around like a headless chicken.

# Abstract

This project is about making school learning easier for children with Dyslexia. Dyslexia is a Specific Learning Disability in which a person with average or above average IQ faces difficulty in reading and decoding words. There are approximately 5 to 15% (diagnosed) such students studying regular schools, struggling to stay par with the progress of the class and often being labeled 'dumb' or 'stupid', despite being gifted and intelligent individuals.

This projects takes a deeper look into the mind of a dyslexic person, analyzes different teaching methods that are employed to teach such children and experiments with designing a new teaching methodology that is considerate of the crux of Dyslexia and makes school less of a dread for a dyslexic person. A practical approach involving ground testing and consultations with special educators, was taken for this project. Building upon what all has already been done in this field, this project will be a visual animated dictionary that combines the spelling of the word in such a way with its meaning or visualization that it becomes easy to remember for a person with dyslexia.

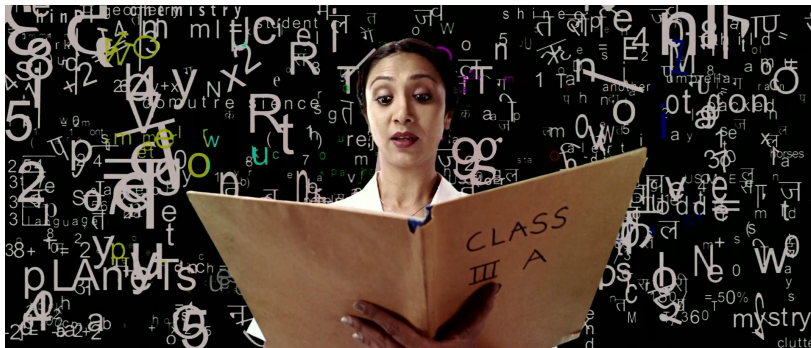
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# Introduction

Dyslexia is an intriguing problem. It is a 'Specific Learning Disability' which makes it difficult for an otherwise intelligent person to read or decode written words. The important part here, is that it's a specific learning disorder which means that while it manifests in a person's reading ability, it does not affect other aspects of learning, intelligence or behaviour. Thus these individuals come across as 'normal', which is why a learning disability is also called an 'Invisible Disability' and which makes recognizing or diagnosing it even more difficult.

It seems disheartening that despite being people with average or above average intelligence, they're usually at the bottom of their class at school and struggle with simple things that people of their age easily manage. And not just does it affect their academic performance, it also results in a very low self image.



still from film- Taare Zameen Par

But apart from this very definitive handicap, people with dyslexia almost always have certain talents or a set of things they're naturally good at.

One such talent is that they're good at lateral thinking and have a creative approach to things, which also explains to a certain degree why they find reading not just difficult but also dull and boring.



image source: [www.forestvilleoptom.com.au](http://www.forestvilleoptom.com.au)

While visiting Learning Disability centers and observing dyslexic people during my study, several facts about that I had read about dyslexics were reinforced. There was a decided inclination towards auditory learning over written and a preference for images-based communication. Multi-sensory approaches have been especially known to be a success.

Interestingly, as I studied dyslexia and the teaching methods that work well with dyslexics, a concrete path started unfolding towards a teaching solution based in animation as it is more engaging and uses both audio and visual channels to communicate. A participatory design that involves the user would fortify it even further.

Several concepts sprung as I sought to exploit this possibility. I decided to focus on the more urgent problem of reading and writing, and I've chosen to make a system that makes remembering spellings easier for children of different age groups. For now titled 'Lexy' the project aims to take up words out of the

tried and tested Dolch's list of words that appear frequently in children's literature and syllabi, along with words from other similar lists. 'Lexy' would act like a lexicon for the dyslexic as it would make the spelling of the word visual, representing it in such a way with its meaning that the two become inseparable and easier to remember.

The project is still at the development stage where iterations are still going on in the main wireframe, even though the central idea and technique are settled.



image source: [www.learningspy.co.uk](http://www.learningspy.co.uk)

# Initial Study

The first step for me after taking up the topic was to read up everything about learning disabilities that I could lay my hands on. Beginning from a preliminary internet research, I went on to read papers written on the subject and in the final phase of the data collection, I visited learning disability centers and interacted with dyslexic people, special educators and therapists.

The term 'learning disability' was first coined in 1963 by Dr Samuel Kirk, a psychologist, while he delivered a speech at an education conference held in Chicago. He had observed that these so-called 'scholastically backward' students could be helped by specific methods of teaching. This was probably the first time the discrepancy in the IQ of a person and their academic performance was highlighted.

The basic categorization of learning disabilities is like this:

- **Dyslexia**

Reading Based. Child has difficulty in reading and decoding print. There's also a difficulty in identifying or comprehending words from their spellings. Decoding print is such a struggle that they miss the meaning of what they read.

- **Dysgraphia**

Writing based. This is a writing disability wherein the child does not have the complex set of motor and information processing skills that are required for writing. Handwriting is usually bad or slow and the pencil grip is awkward.

- **Dyscalculia**

Math based. The child would have difficulty understanding symbols and numbers and understanding basic math concepts. Remembering or recalling number sequences is also an issue.

- **Central Auditory Process Disorder**

Auditory based. This is an auditory processing disability in which the child has difficulty in processing information he or she hears and in interpreting spoken words. This is not a hearing problem, only the brain cannot process information heard.

- **Attention Deficit and Hyperactivity Disorder (ADHD)**

Attention based. The child with ADHD has difficulty in staying focused and paying attention. There is also difficulty in controlling behaviour and hyperactivity or over-activity.

- **Dyspraxia**

Motor skill based. Dyspraxia is the disorder in which the child faces difficulty in activities requiring coordination and movement. Very often, not being able to wear the correct shoe or tie shoelaces are the earliest symptoms.

## Study of Books and Research Papers

Many experts have written extensively about learning disabilities especially dyslexia. A paper by Dr. Sunil Karande, Ms. Rukshana Sholapuwala and Dr. Madhuri Kulkarni, states, **“This invisible neurological handicap is believed to be a result of functional disruption in neural systems rather than an anatomic problem and is genetically inherited. Dyslexia afflicts 80% of all children identified as having SpLD”**.

The paper goes on to elaborate the efforts taken in India for students with dyslexia. In 1996, the Maharashtra government was the first in India to formally grant children with special learning disability the benefit of availing the necessary “accommodations” to enable them to study in regular mainstream schools. These accommodations include- extra time for all written tests with spelling mistakes being overlooked; employing a writer for children with dysgraphia; exemption of a second language (Hindi or Marathi in an English medium school) and substituting it with a work experience subject; and exemption of algebra and geometry and substituting it with lower grade of mathematics (standard VII) and another work experience subject. A Learning Disability Certificate can be obtained from screening centers authorized by government for availing these provisions.

Since then, National Educational Boards CBSE and ICSE along with state governments of Karnataka, Goa, Tamil Nadu, Kerala and Gujarat have also recognized Specific Learning Disability as a disability and have granted these children the benefit of availing these provisions.

However in another paper on learning disabilities by Dr. Marita Adam, Ms. Samrudhi Bambolkar, Ms. Nadia C. Fernandes, Ms. Ritwika Srivastav, Dr. M.E. Yeolekar and Dr. Madhuri Kulkarni, a comment on the execution of India’s policy of ‘inclusion’ in education is made, stating “Various schemes have been offered for the welfare of the disabled population, but the benefits often do not percolate to the disabled people, their families and organizations that work for them because of lack of awareness. The cumbersome and time-consuming procedures of availing the benefits also create hurdles in implementation.”

Parents are also often uncooperative as there is a social stigma related with learning disabilities in the marks and percentage-driven social scenario of India. Where ranks in classrooms and success in competitive exams are the sole measure of a child’s intelligence and capability to contribute to the society, parents are often in denial.

The paper also mentions that **dyslexia was a term coined to describe right brained thinkers who have difficulty in reading, think in pictures and are very imaginative and multidimensional**. Famous personalities, Walt Disney and Albert Einstein are few of the examples of dyslexics who failed school but went on to achieve great things out in the real world. More examples include Richard Branson, Scott Fitzgerald, Marie Curie, Nikola Tesla and Jules Verne.

People don't realize that dyslexia is also associated with a special set of perceptual skills – some of which offer definite advantages. I came across a recent article in the New York Times aims to promote greater awareness of the upside of dyslexia. In an experiment conducted by MIT shows that typical readers are better at focusing on words in the center of their field of vision. However, readers with dyslexia, have stronger and more accurate peripheral vision.

Being able to focus on the details in the center of a page is the key asset in learning to read, but it means that most people are quite weak at recognizing broader features and patterns outside of that small area of focus. In case of dyslexics, it simply reinforces what has been observed so far – that dyslexics are intuitive, big-picture thinkers who are more aware of their surroundings. Several other experiments done at MIT and University of Wisconsin yield similar results with few more things to add. It even turns out that students with dyslexia have

a superior ability to understand and process visual information in certain contexts.

These studies not only show the upside of dyslexia but also the root of the problems they encounter. People need to understand that dyslexics are challenged in some aspects but are also genuinely gifted in some others.

Thomas Petzinger says in his article titled 'A Banc One Executive Credits His Success to Mastering Dyslexia', in the Wall Street Journal, 24th April 1998- "Don Winkler has a brain for the 21st century. A dyslexic brain. As other managers struggle to 'think outside the box,' Mr. Winkler has no other way of thinking. . . . In five years he has built the finance arm of Banc One Corp. from an industry also-ran to \$26 billion in assets. How he did so says a lot about Mr. Winkler and the value of quirky thinking in a chaotic business world."

In order to understand the dyslexic mind better and find out the scope and need of a design project, I looked into the methods that are popular and effective in teaching dyslexic children. In the book 'How to Detect and Manage Dyslexia' by Philomena Ott, she has explained the methods that are used to teach reading to children with dyslexia:

### The 'Whole Word' or 'Look and Say' Method

This is also called Sight Words. In this method the repeated visual of the written word's spelling or its meaning makes it easy for a child with dyslexia to memorize it and recall it later.

### The Phonic Method

This is an extremely auditory based teaching method that relies on the capability of a dyslexic person to learn via hearing and is fairly popular. The child is taught the relationship

between the letter names and the sounds of the letters.

### The 'Whole Sentence' Method or the 'Language Experience Model'

In this method, pupil learns to read sentences and it is the content of what is read that is of primary importance. He is encouraged to use the meaning of the sentence to make sense of or guess the meaning of individual words. Also called the Cloze Procedure.

### Alphabetic Multi Sensory Method

In this method, the child is encouraged to see, feel and hear letters simultaneously. It engages more than one of their senses and is quite effective with children who have ADHD as well.

examples of Sight Words-

can	come
find	go
help	is
jump	look

Sight Word Guess Who?				
yes	eat	all	saw	good
so	will	have	am	what
who	too	get	he	now
but	at	did	into	like
that	out	are	was	no

image source: [smile-creativeteacher.blogspot.com](http://smile-creativeteacher.blogspot.com)

# Insights and Upsides

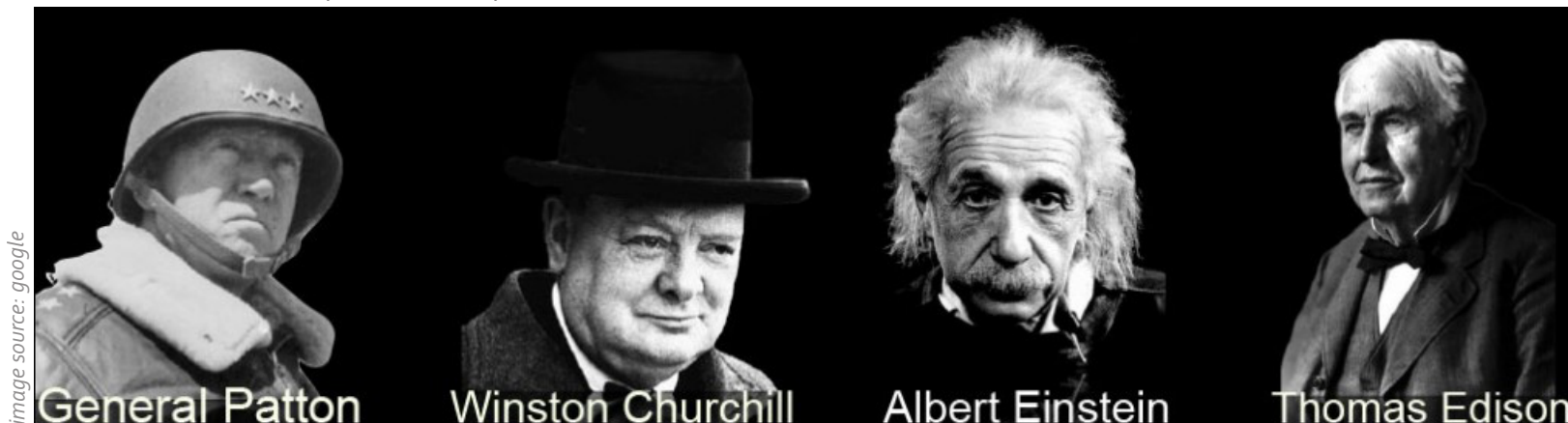
Though dyslexia is simply a different way some people are neurologically wired and has its ups and downs, in India its considered a taboo. Teachers and even parents have little idea and resources to deal with it. Such kids often never really realise true potential because they had been told too often that they couldn't do it.

There are several success stories because many famous people are dyslexics who just realized that this condition is something they would have to live with and which comes with its own gifts. They make successful entrepreneurs, managers, actors, comedians, singers and even writers. Having failed several times in life, they are intrepid risk-takers and often rise when they run their own show. Their being big-picture viewers make them great top-bosses and they usually have good interperson-

al skills that make them popular. They prove that success in school is nothing to go by when it comes to success in the real world.

Even then, despite the stigma, India is fast recognizing the existence of learning disabilities as several provisions are already in place. But better understanding of the whole bracket of special learning disabilities like dyslexia, dyscalculia etc. needs to be cultivated and the different teaching methods need to be explored more.

Some of the Famous People who had Dyslexia



## Portrayal in Literature & Films

People with learning disabilities aren't that commonly found in books or movies, though they make extremely interesting fictional characters with lovable flaws whenever they make an appearance. Popular Hindi film 'Taare Zameen Par' is an excellent example of a sensitive account of a talented but dyslexic child's struggle-filled journey through studies, acceptance at home and school, towards finding himself. So I dug up some fictional dyslexics and read how they had been portrayed in books.

Another such lovable character is that of irrepressible Helen in the book 'Sixth Grade Can Really Kill You' by Barthe DeClements. The book tells the story of bright and spirited sixth-grader Helen who is confused as she finds herself struggling at school studies despite her efforts. Her parents don't want to believe anything is wrong with her and she herself has no clue. Though she is smart enough to invent crafty ways around her problem and stay at par with the class without anyone realizing that she is dyslexic, she also starts to get frustrated and rebellious, and starts drifting away from her friends, family and the conventional norms of disciplined education.

Repercussions of dyslexia in the world outside of school are amply shown in the book 'Dying to Know You' by Aiden Chambers. This is the story of a young dyslexic man who works as a plumber and is hopelessly in love with an articulate bookish young girl who wants him to write letters to her to tell her more about himself. Young Karl now ropes in an old experienced writer to voice his love story and a strange arrangement of trust, new love and respect develops.

Sixth Grade Can Really Kill You  
by Barthe DeClements

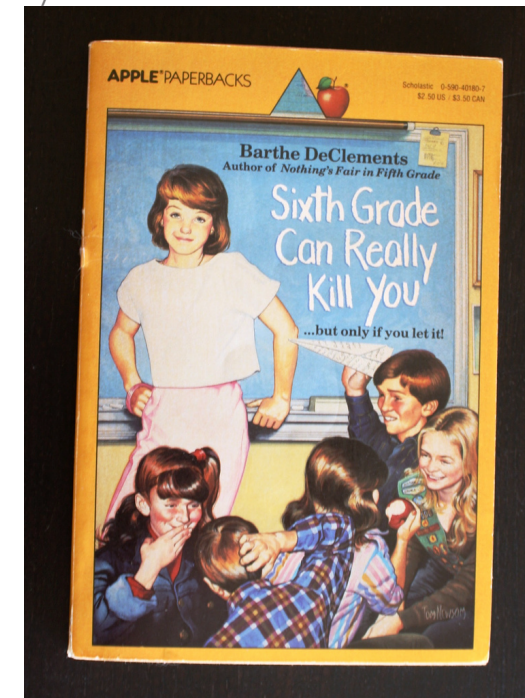
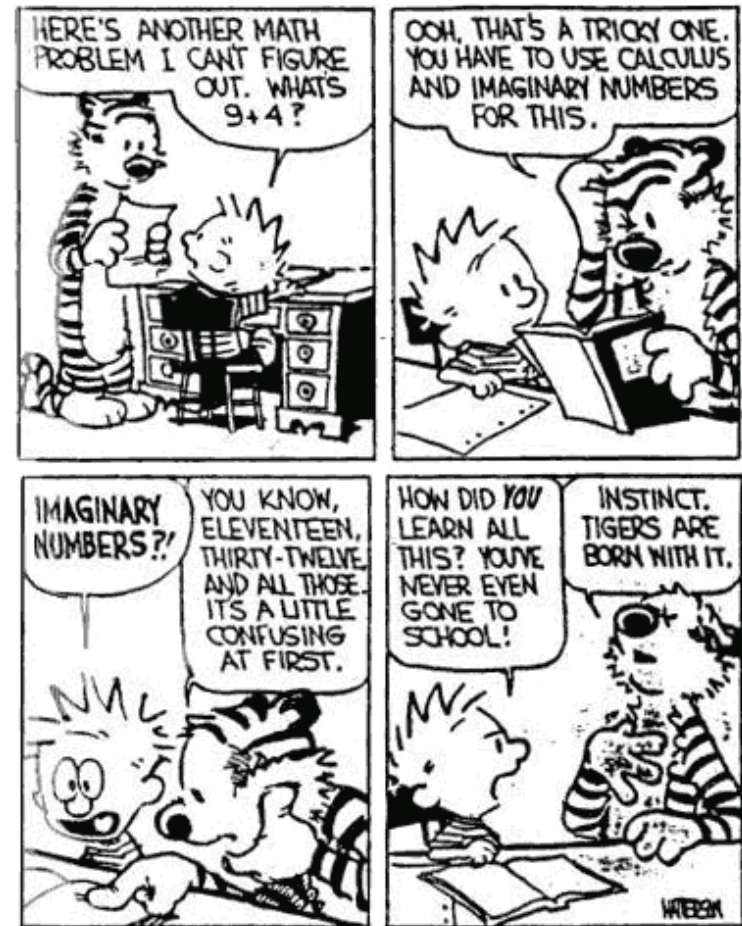


image source: flickr

Books that have characters with learning disabilities are mostly written from the perspective of the person and they're usually the protagonist. Several books spoke about resource rooms and remedial education that made the problem easier. Bullying and name calling also figured frequently. The protagonist is shown falling into misbehaviour and rebelliousness, in many instances, mostly to cover their academic shortcomings.

Calvin is imaginative, articulate and rebellious.  
And probably Dyscalculic.



## Places Visited & Interviews

I talked to and visited many people to discuss and observe dyslexia and how it is dealt with in Mumbai. Taking a look as to how various learning disabilities are recognised and what methods & materials are used to help children who have dyslexia as well as other developmental disorders.

- **Ms. Manisha Mohan**

Is head of Tata Interactive Systems where interactive content is created for kids with various learning disabilities.

- **Learning Disability Clinic, K.E.M. Hospital, Mumbai**

Is the place where children are screened and go through a series of neuro-assessment tests. Certificates handed out here entitle a child to special provisions at school.

- **Ms. Rukshana Sholapurwala**

Is the clinical psychologist and special educator that screens the children at KEM Hospital.

- **Ummeed Child Development Center**

Is an NGO in Lower Parel Mumbai that helps children with various disabilities and has its own teacher training programme.

- **Ms Veena Basu**

Is a special educator and the founder of the Verve Center in Breach Candy Mumbai.

- **Ms. Namita**

Is a special educator with the Verve Center and teaches dyslexic children

- **Ms. Preeti Chowdhry**

Is a counselor and therapist at the Modern School, at Khan Market Delhi and runs her own center for children with special needs.

At the K.E.M. Hospital Learning Disability Clinic, there is usually a long queue of parents with their kids, each with a letter in hand from their respective schools, referring them to get a Learning Disability screening test done. The kids have a separate IQ test and screening test specially developed by Ms. Rukshana Sholapurwala. This test is made, keeping in mind the Indian school's syllabi and has sections that require different skills. The crowd that comes to this clinic is usually a homogeneous mix of all neurological disorders and not just dyslexia.

Though the ages of the children vary highly, according to Ms. Sholapurwala, it is the 9th standard from which they get the maximum number of students. And there is a reason for this. "Under recent amendments, it is mandatory for schools to promote students till the 8th standard- they cannot be marked fail" she explains. In such a scenario, even kids who have LDs (Learning Disabilities) are blindly promoted despite their poor performance in certain subjects. And since it is the schools that send these children to the KEM Hospital for screening, it is mostly students of 9th standard, the standard where they wake up to find something is wrong.

Ms. Preeti Chowdhry of Modern School, however, reckons that though the classes 7th, 8th and 9th are difficult for a dyslexic, classes 3, 4, and 5 are also a problem because this is where the school course suddenly becomes more complex for a child. Uptil the 2th standard, the children perform more or less the same and the difference between the highest and lowest performer in class is not that great. But the 3, 4, and 5th are the classes where the complexity of the course, number of subjects and the length of words etc. increases. Besides, it is quite difficult to recognize an LD before the 3rd class.

Ms. Namita at the Verve Center reiterates that the sooner a

learning disability is recognized the better. By 9th most of the damage is done, not only to the academic development but also to the child's self-esteem. In her opinion if either of the parents understands dyslexia, the plight of the student is halved already. In fact she even went on to say that a parent taking on the role of a special educator and giving their child remedial classes after school is a highly recommended arrangement.

At the Verve Center, the teaching mostly follows the phonic system. There is also a special set of books based on this system that have been developed by the founder Ms. Veena Basu. The books begin with elementary phonics and move towards more advanced sounds in levels. There is also a special focus on cognitive skills training and the idea of 'neuroplasticity' or the concept that the brain can be rewired, is also being explored.

K.E.M. Hospital, Mumbai



Ms. Veena Basu, Verve Center



At all these places, I observed a decided preference of questions being asked orally by the dyslexic students. Another interesting thing that I noticed was that most dyslexic kids had good social skills and when they were asked to sit at a desk and do the screening test at the KEM Hospital, they were more curious about their new surrounding and were more interested in smiling and making eyes at each other with the least concern for the question paper, probably because they knew nothing in it! Some of my other observations are mentioned below:

- One thing that I witnessed that emphasized the MIT experiment with dyslexics mentioned earlier, was when a child was given two images and was asked to find the differences. The child was confused for a while and replied that there were no differences. The special educator pointed out to me that the child was looking at the gross image or the 'Bigger Picture' as the MIT experiment had concluded and was thus, unable to see the fine differences between both the images.
- Also mostly the children were very visual thinkers, always exhibiting a preference for things that have images on it and always getting the answer right if an image was used in the question.
- At the Ummeed Development Center, the children are also taught this concept of 'dressing up your speech', which is, simply put- using proverbs and expressions that do not literally translate into their meanings, e.g. 'Blue collar job' or 'Losing one's head'. This is because dyslexic people are very practical and literal-minded, and find understanding proverbs, figures of speech and indirect expressions difficult to understand.
- At all of these learning centers, the instruction happens one-on-one. This way the child gets the educator's complete attention and the educator does not move forward till they're sure the child has grasped the concept.
- There is also an invariable difficulty in writing faced by the dyslexic students. The handwriting is uneven, the letters frequently reversed and the fine motor skill is poor.
- If the method of teaching involves audio as well as visual, as in a film or a person explaining things in a book (person explaining: audio, book:visual), the chances of the child grasping the concept are higher. Children with LDs often display signs of ADHD as well. So if the teaching method engages more than one sense, the child has greater chance of paying attention.
- Different learning centers have their own set of learning resources that the special educators or clinical psychologists use as per their discretion. Some follow the Dolch system of phonetics while some use a mix of things like flashcards etc.

# Methods That Are In Use

## Phonics

This method involves developing the learner's phonemic awareness. Instead of teaching the 26 alphabets, it is based on the 72 sounds according to their phonic patterns.

72 PHONOGRAMS						
a	b	c	d	e	f	g
h	i	j	k	l	m	n
o	p	q	r	s	t	u
v	w	x	y	z	sh	ee
th	ay	ai	ow	ou	aw	au
ew	ui	oy	oi	oo	ch	ng
ea	ar	ek	ed	or	wh	oa
oe	er	ir	ur	wor	ear	our
ey	ei	eigh	ie	igh	kn	gn
wr	ph	dge	tch	ti	si	ci
ough	gu					

Single-letter / Single Sound Phonograms			
b	d	f	h
bee	crib	dad	dragon
fun	face	hug	
j	k	l	m
jump	job	king	lollipop
me			
n	p	r	t
noon	puppy	road	race
tablet			
v	w	x	z
valentine	wag	wiggle	x-ray
fox	zip	the	zebra

Single-letter / Multi Sound Phonograms		
a	e	e
am	a	ball
cat	city	elk
me		
g	i	o
goat	giraffe	it
giant	radio	on
over	love	to
s	u	y
sent	as	up
use	put	your
gym	fly	quickly

image source: www.gopixpic.net

Chart 2 Consonants		
B b	K k	S s
C c	L l	T t
D d	M m	V v
F f	N n	W w
G g	P p	X x
H h	Q q	Y y
J j	R r	Z z

Chart 12	
ch	in church
sh	in ship, wish
th	in thick, with
th	in this
wh	in whale
wh	in who

Chart 16					
kn	in	knee	ie	in	brownie
gn	in	gnat	ey	in	key
a-	in	asleep	ey	in	they
a	in	banana	ought	in	thought
o	in	son	aught	in	taught
c	in	race	igh	in	night
ea	in	heat	y	in	myth
ea	in	head	g	in	giant
ea	in	great	dge	in	fudge

image source: www.phonictalk.com

The School Run.com

# Phonics sounds

Group 1		Group 2		Group 3	
s	snack, sounds	ck	duck, clock	g	grow, soggy
a	apple, animal	e	egg, best	o	long, holiday
t	tall, treat	h	hand, happy	u	sun, under
i	spill, Imagine	r	rest, parrot	l	silly, light
p	strap, present	m	meet, mummy	f	fluffy, friend
n	nice, bunny	d	dive, daddy	b	ball, baby

www.theschoolrun.com

Image source: www.theschoolrun.com

image source: www.theschoolrun.com

These phonic patterns are categorized and clubbed according to the complexity of the diagraphs (a combination of letters used together)

## Phonics With Visuals

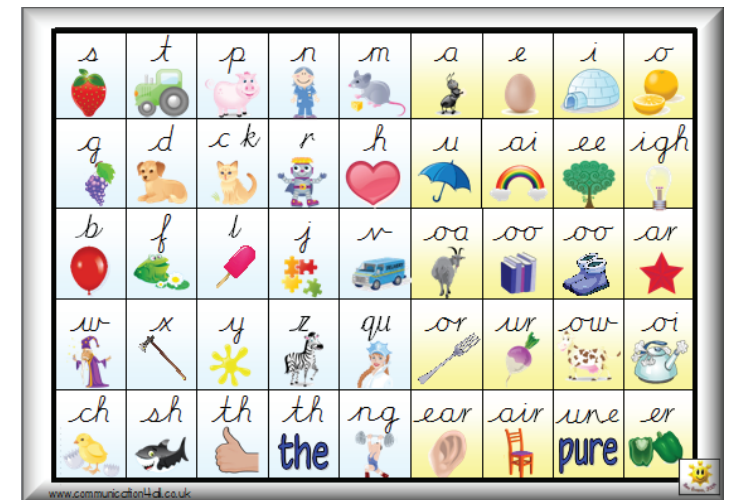
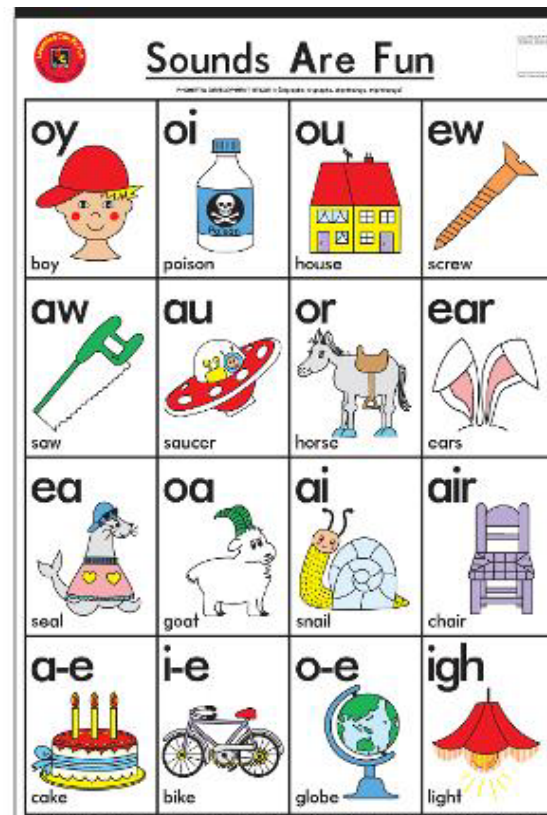


image source: [www.communication4d.co.uk](http://www.communication4d.co.uk)

When aided with visual cues, phonics become easier to grasp by dyslexic children and it makes it easier to remember. Also used as flashcards, these are fairly popular methods of teaching.

Ms Preeti Chowdhry recommended me to take a look at 'Picture It' a highly effective program by Sandcastle Technologies which is along the same lines as the phonics with visuals and 'Look and Say' method of teaching.

Picture It can transform any text or paragraph into a set of images, with one image visualizing each word. This simplifies the chunk of text into images that the dyslexic mind can understand. Most of us might find this garble of images and text a tad confusing, but it seems that it simplifies text considerably for a dyslexic.

However, there are some arbitrary images and/or images that could be difficult to comprehend on their own.

Screen shot of 'Picture it'

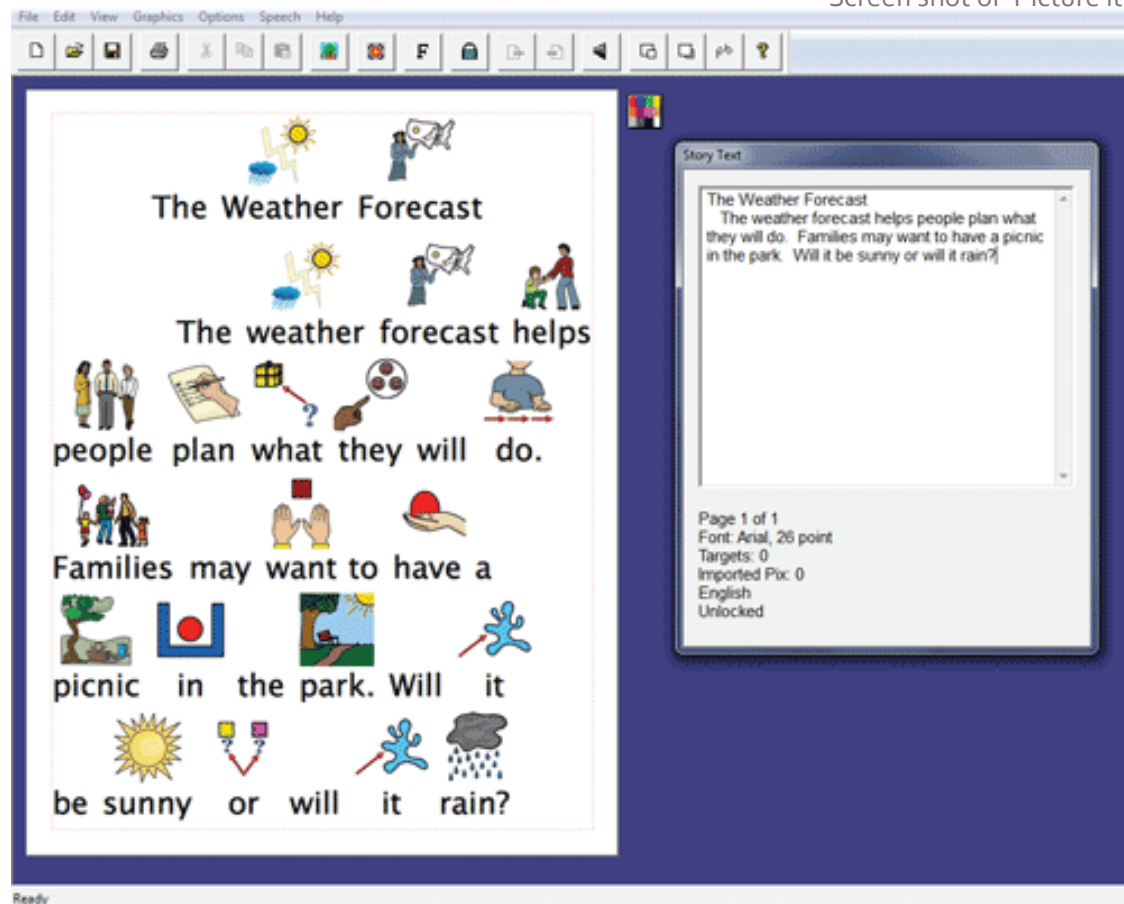


image source: sandcastletech.com

## Sample of Different Exercises

Going through the books and resources at different Learning Disability centers, I found various excersises that use visual cues to teach reading and alphabet differentiation among other things.

These are samples of the different kinds of exercises that are in use for teaching children with dyslexia. Each exercise aims at the use of a different skill.

All these exercises on the right are replicated here by me and in the teaching material (books, flashcards etc) they were preceded and followed by a number of questions in the same pattern.

For example, the top right image is from an exercise that aims to make the child formulate the structure of the sentence using Sight Words.



Woman \_\_\_\_ bread

shakes bakes banks



CHAIR or STAIR

Re-arrange to make a sentence:

The ran dog away fat

Find the Relation:



PARROT is to WINGS



a

b

c

FISH is to ?

Find the sound: 'ee'

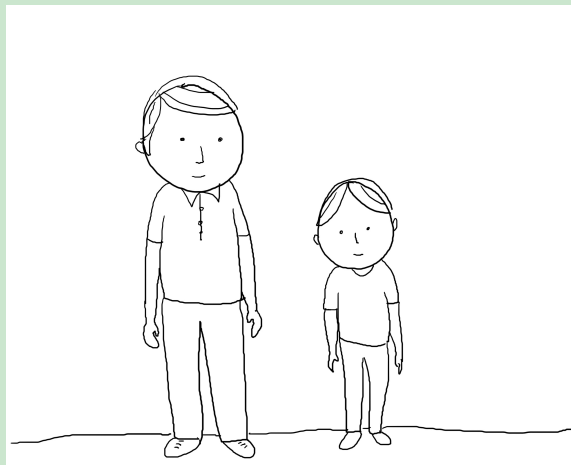
Here is a bee.

The boy sees the bee.

## Phonics at Verve

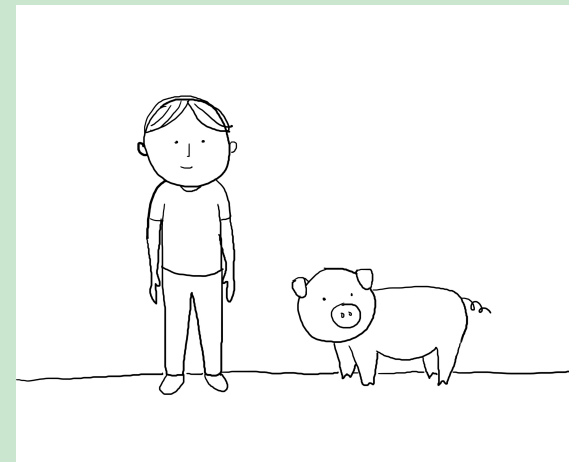
Ms. Veena Basu, founder of the Verve Center, has developed her own system of phonics. It contains a series of books and each book explores the one particular phoneme. The phonemes progress to more complex digraphs at the higher level books. The content of the book is simple. There is one image with text under it. The words explore each possible sound and application of the chosen phoneme. Even though the language is a little archaic, the books are designed to be simple and easy to read.

level:1 book 1



Dad's lad is Dan

level:1 book 2



Kim the Pig

## Restated Brief

Children with dyslexia are bright and gifted, only a little differently wired. Their inability to grasp certain subjects at the pace of a normal child makes them struggle a lot at school and lowers their self image.

Based on the study of the methods that are currently used for teaching children with dyslexia, and considering the mindset of the dyslexic which is very visual-thinking and inclined towards multi sensory approaches in instruction, I have decided to explore how animation could be used as a tool to create learning methodologies that would make learning easier for the dyslexic child.

# Design Ideas

There is no dearth of problems to be solved in a dyslexic's life. Their school life is the hardest hurdle and I knew my project would have to come up with an idea to make it easy for them. Writing, reading, comprehending and remembering are all areas that need to be addressed for a dyslexic child.

## Concept 1- A Writing App

This concept is aimed at developing the fine motor skills of writing. Writing is almost always an issue for those with Dyslexia and this app would attempt to train that.

Along with audio cues, the user would have to trace the word that appears on the screen of the tablet within stipulated time.

There would be options to make the image of the word brighter or near invisible- so that the user can employ his/her own memory and rely less on the guidelines.

To increase proficiency, the size of the word can also be made smaller.

Age Group: 5 to 8 years



## Concept 2- Animated Poetry & Proverbs



Poem 'The Man With The Beautiful Eyes' by Charles Bukowski  
made by Animator Jonathan Hodgson  
and Illustrator Jonny Hannah

For the literal minded dyslexic, grasping the meaning to figures of speech or indirect expressions is always a problem. I found the fact that the beauty of poetry and other literature is lost upon these individuals, quite unsettling.

In this concept, I planned to depict metaphors and figures of speech visually with the help of expressive typography, include the written word in the scene in such a way that it becomes a part of the visuals.

They would be animated videos of a poem from the child's course or a proverb/ idiom in accordance with their age.

Age Group- 7 to 18 years

### Concept 3- Animated Dictionary

image source: [www.resourcesforteaching.com](http://www.resourcesforteaching.com)



This concept is aimed at helping dyslexic children remember spellings easily. Dyslexic children often don't comprehend the meaning of what they just read, so this concept merges the meaning with the spelling of the word. When a further audio narration is added, it would increase the memorability for the dyslexic mind.

The top two images on the left are a good example of how teacher Sarah Major has made the spelling become a part of the meaning.

An audio-video presentation would be able to take this a bit further with clarity about the pronunciation of the word especially if certain other key elements that aid memory for a dyslexic are added; and including options to use the particular word in a sentence so that it also gives an opportunity for the child to expand his/her vocabulary and benefit by learning new words.

Age Group- 7 to 16 years

image source: [www.resourcesforteaching.com](http://www.resourcesforteaching.com)

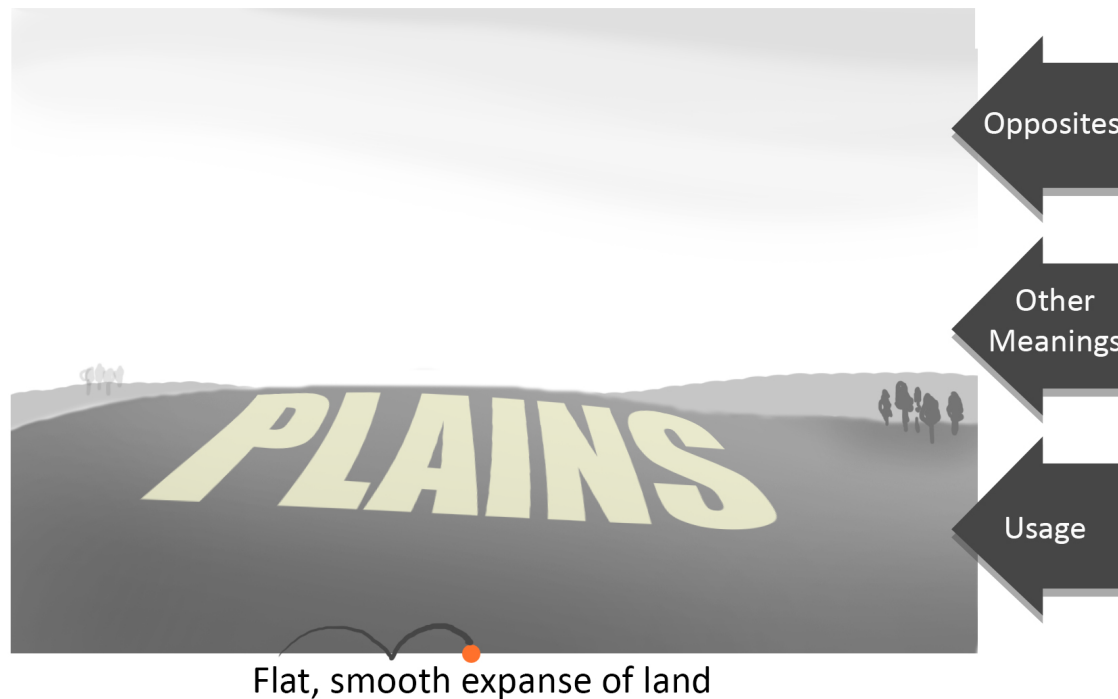


# Final Concept: Animated Dictionary

From all that I had seen or read, I remembered the struggles of a dyslexic to read and write correctly and realized that remembering spellings and comprehension are some of the more urgent problems of a dyslexic, and so I settled on the Concept-3, the Animated Dictionary.

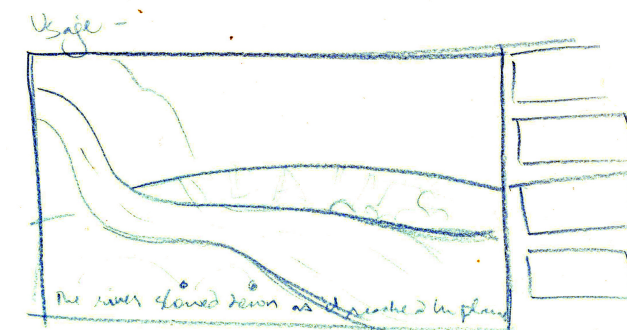
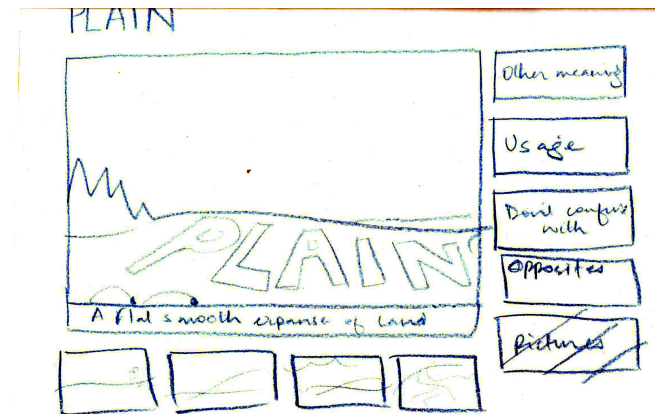
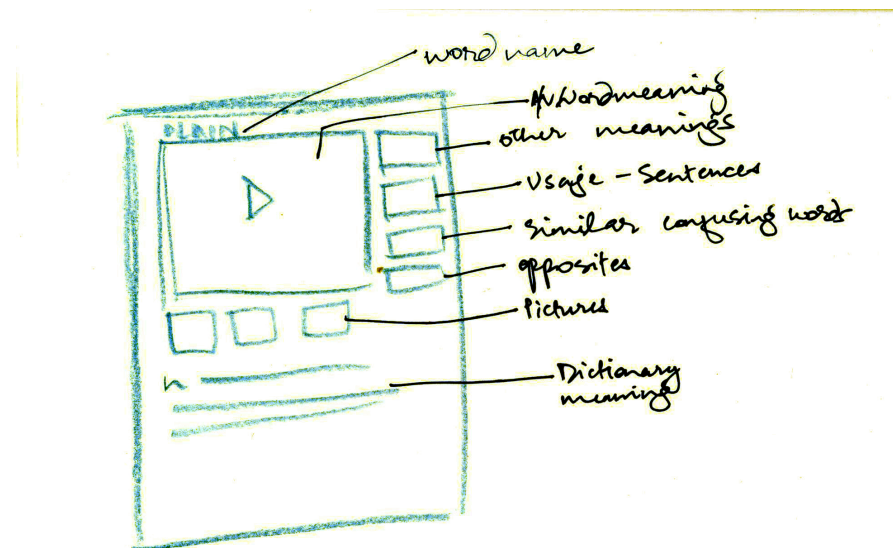
Through this concept, I'm trying to translate a word of the English language, which is difficult to decode for a dyslexic, into a language of visuals that they understand. An audio narration would help the child learn the pronunciation and use in a sentence. Below is the basic initial idea of how the dictionary would look like and what all things it'll teach.

## PLAIN



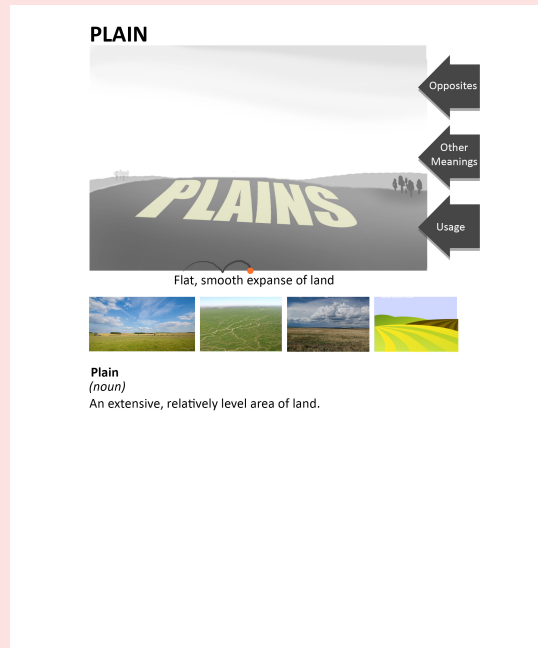
I began with a rough wireframe that laid out not only the structure of the dictionary's interface but also the things that would be included in it. I planned to put things like, Usage of the word in a sentence, its opposite, its other meaning and words that sound or are spelled similar apart from the definition of the word.

Rough sketches of the Interface

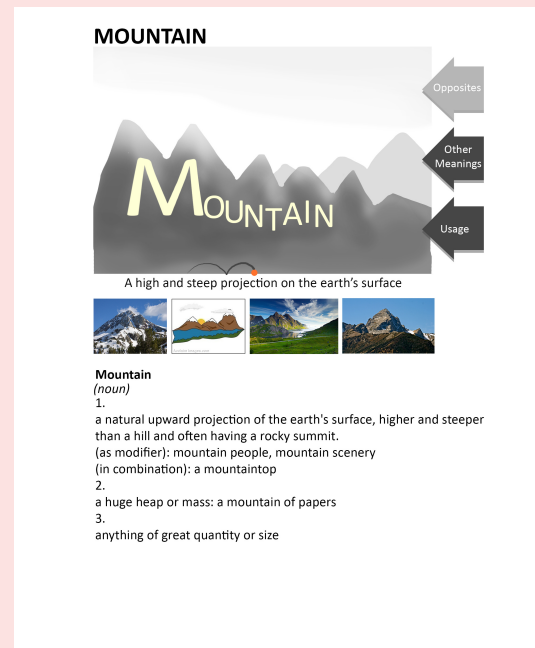


# First Sample Mock-up

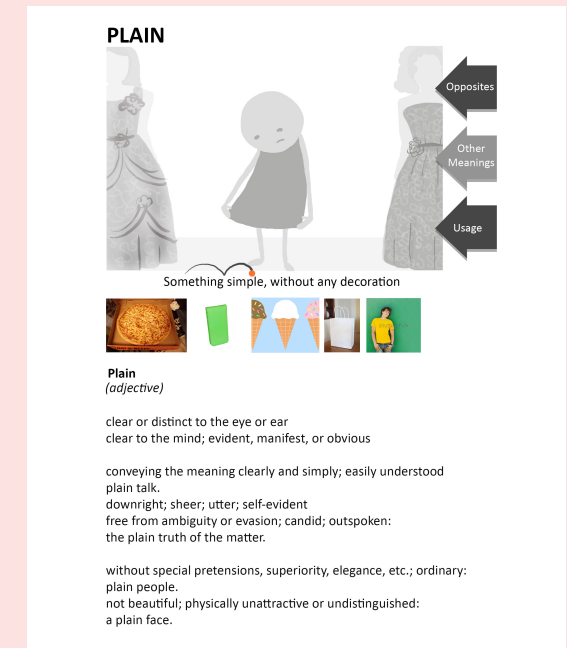
screen 1



screen 2



screen 3



In the first sample, I chose to put 3 buttons on the sides for opposites, other meanings and usage. Each would have its own video that would open in the video window when the button is pressed. Apart from that there would also be a karaoke-like subtitle of the narration that would be heard. Also, I put internet images of the word under the video window to help in greater clarity about the meaning of the word.

## Feedback on First Sample Mock-up

On sharing the first sample mock up with faculty members and a couple of special educators, I got some very helpful and specific feedback. Before creating a high fidelity mock up to be tested with the dyslexic children, I wanted to get the basic things straight. Among the first things brought up by my faculty members at IDC was that there was still too much text on the screen and the solution didn't look visual enough to cater to a visual-minded person. That meant I would have to make the video window larger and take out the excess text.

Ms. Preeti Chowdhry commented that the amount of detail in the backgrounds etc. of the visuals would also be of crucial importance because since the dyslexic child who has a good peripheral vision would find highly detailed backgrounds very distracting and might miss what is going on in the foreground which would defeat the entire purpose of the video. She advised me to refrain from adding unnecessary things like moving clouds, grass trees etc. in the visuals unless they were really important because that would be enough to distract the dyslexic child. A similar thing was suggested to me by Ms Veena Basu and I decided to go for simple and clean illustrations.

They also asked me to use standard fonts instead of something fancy as that would confuse the child about how the construction of each letter should look like. Also my guide made me understand that there needed to be a solid backing into the word selection. The dictionary had to be populated by words that would be difficult for dyslexic people. So I had to figure out how to select the words.

# First Iteration

Taking the feedback seriously, I went back and redid some things and worked to resolve the issues. One of the first things that I did was:

## Deciding the Words

### 2nd Grade:

always, around, because, been,  
before, best, both, buy, call, cold,  
does, don't, fast, first, five, found,  
gave, goes, green, its, made, many,  
off, or, pull, read, right, sing, sit,  
sleep, tell, their, these, those, upon,  
us, use, very, wash, which, why, wish,  
work, would, write, your

There had to be some scientific and proven reasoning behind the selection of words I included. Incidentally, there are already lists developed by people that cover the list of words that kids of different ages should know, and which are employed by special educators to teach kids with dyslexia. The most popular one of these lists was the one I turned to- the Dolch List.

The Dolch word list, lists the frequently used English words compiled by Edward William Dolch in 1936. They are used widely with between 50% to 75% of all words used in schoolbooks, library books, newspapers and magazines being a part of the Dolch basic sight word vocabulary.

The complete list of 220 words is divided into grades for children. Although most of the Dolch words are phonetic, it is believed that they can't be 'sounded out' using common sound-to-letter implicit phonics patterns and have to be learned by sight; hence the term 'sight word'. In many schools, lists like these are still given to students to memorize.

## Deciding Fonts

### How Creatures Move

The lion walks on padded paws,  
The squirrel leaps from limb to limb,  
While flies can crawl straight up a wall,  
And seals can dive and swim.

The worm he wiggles all around,  
The monkey swings by his tail,  
And birds may hop upon the ground  
Or spread their wings and sail.

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### How Creatures Move

**The lion walks on padded paws.**  
**The squirrel leaps from limb to limb.**  
**While flies can crawl straight up a wall.**  
**And seals can dive and swim.**

**The worm he wiggles all around.**  
**The monkey swings by his tail.**  
**And birds may hop upon the ground**  
**Or spread their wings and sail.**

For deciding on the correct font, I made a simple font survey and forwarded it to a couple of special educators to ask them which of the fonts the kids with dyslexia would be most comfortable in, for reading.

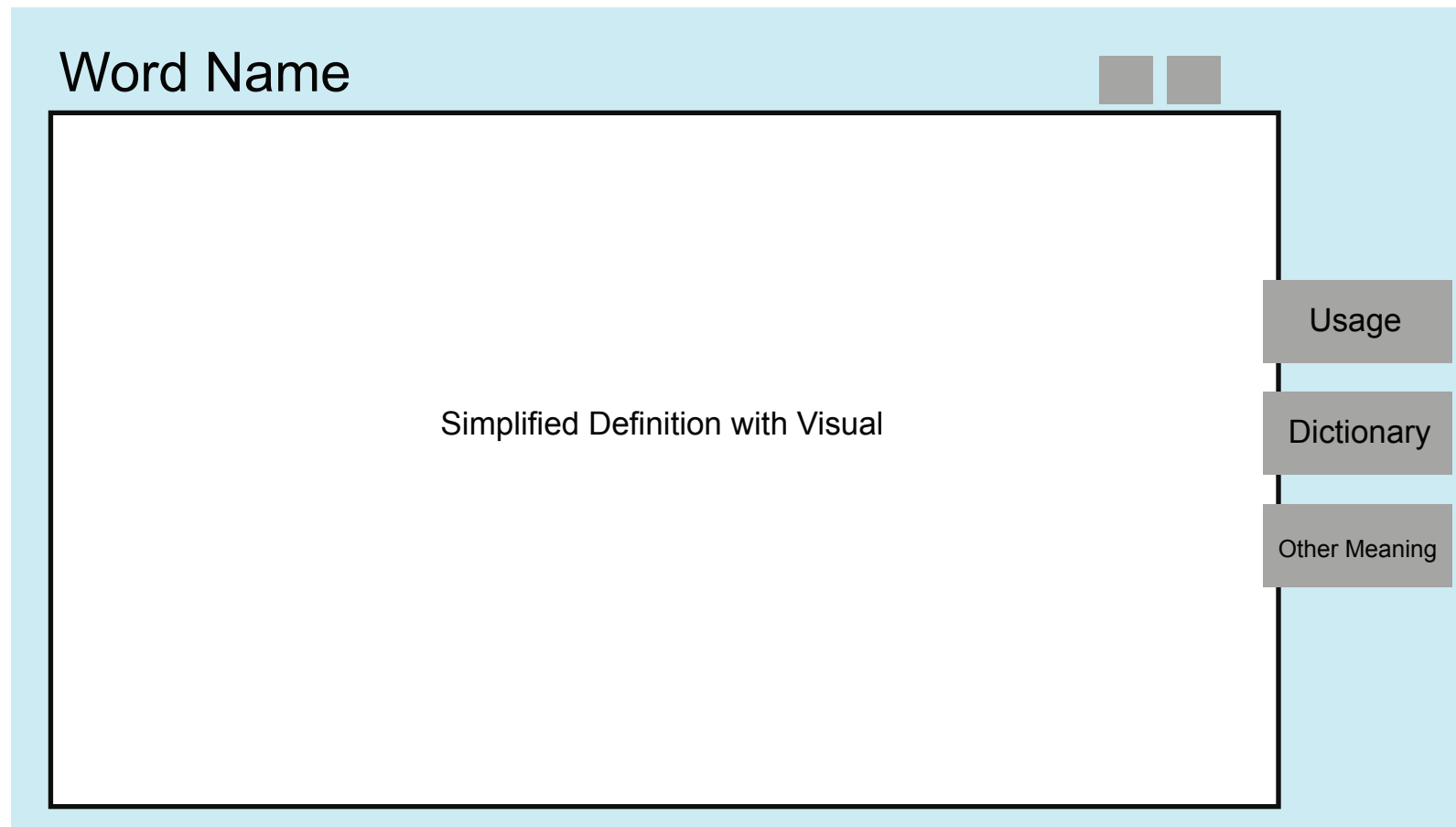
The fonts I sent included two sans serif fonts- Segoe UI and Helvetica; one serif font- Times New Roman, and one fancy looking font- Bahaus.

Helvetica got the highest preference, with Segoe UI coming in second. Least preferred was Bahaus, ruling out any idea of fancy lettering. A couple of dyslexic adults I consulted suggested to me the possibility of using a rounder font as they would prefer that, thus bringing in fonts with rounded edges like Arial Rounded as another possibility.

I also recalled that the font used in Sesame street when they introduced a new word to kids was also a rounded one.

## Second Sample Mock-up

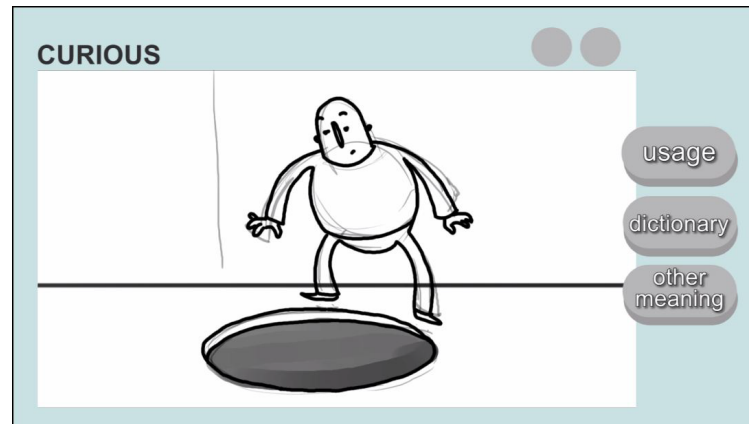
For the second Sample Mock-up I made a new wireframe that was simplified and had lesser options and lesser text. Going by the advice given to me, I decided the video window would almost fill the frame and the dictionary meaning text that was earlier written under the video window, is now condensed into one of the buttons onto the side.



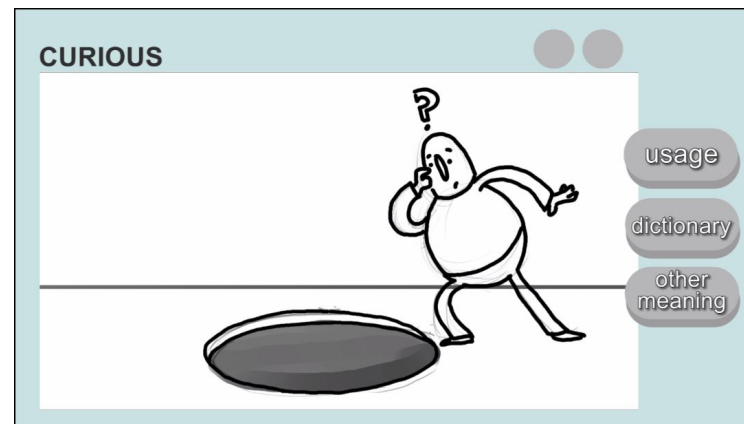
## Second Sample Mock-up with Animatic Frames

This is the second mock-up and the videos for each of the side buttons are storyboarded as well as made into an animatic with sound. Below is the mock up with storyboard panels of the videos

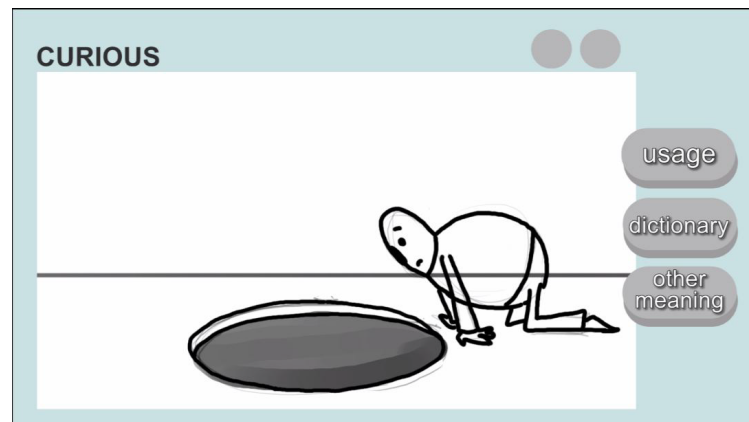
screen 1- Definition



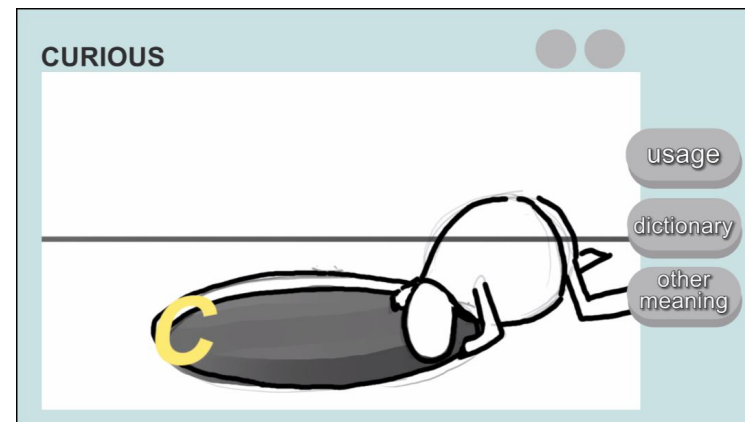
Voice over <'having a desire to know... '>



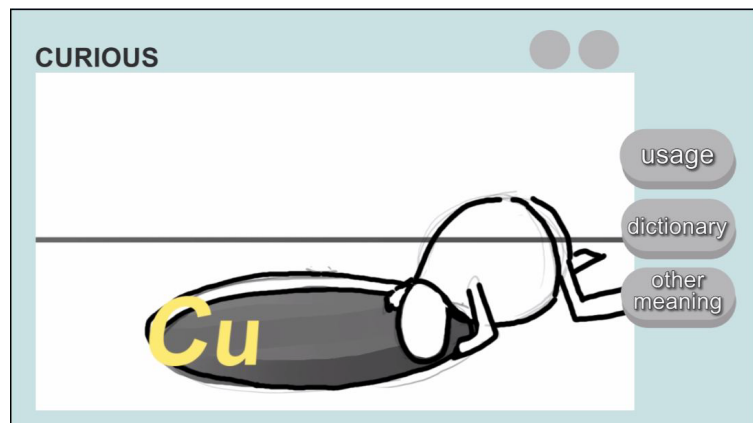
Voice over <'or find out'>



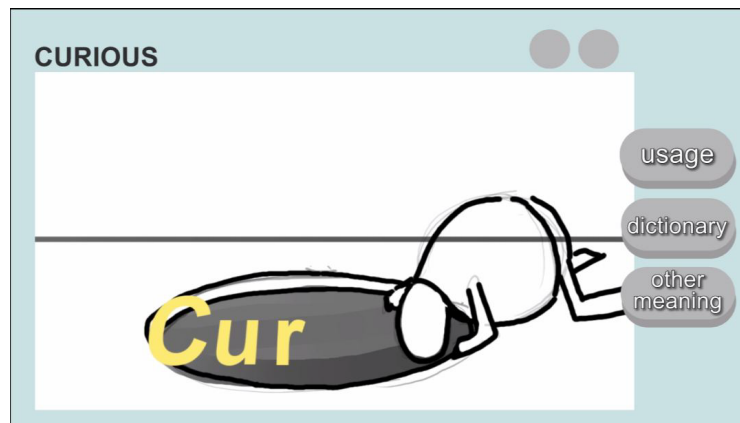
Voice over <'something.'>



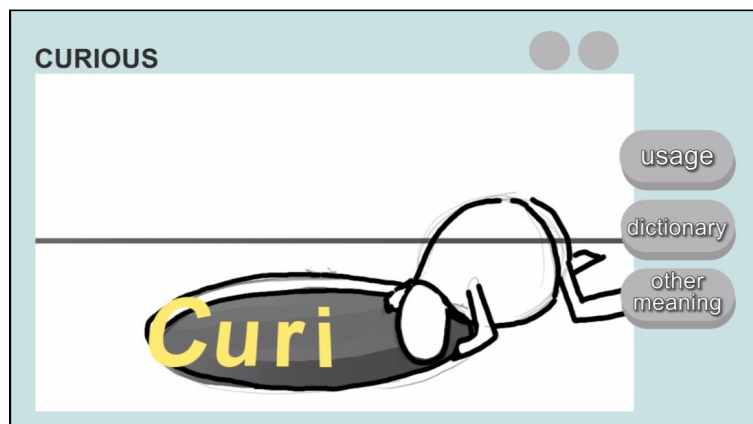
Voice over <'C'>



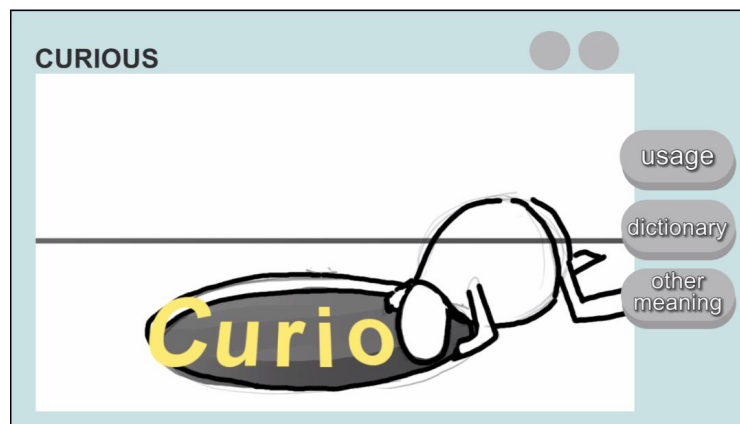
Voice over <'U'>



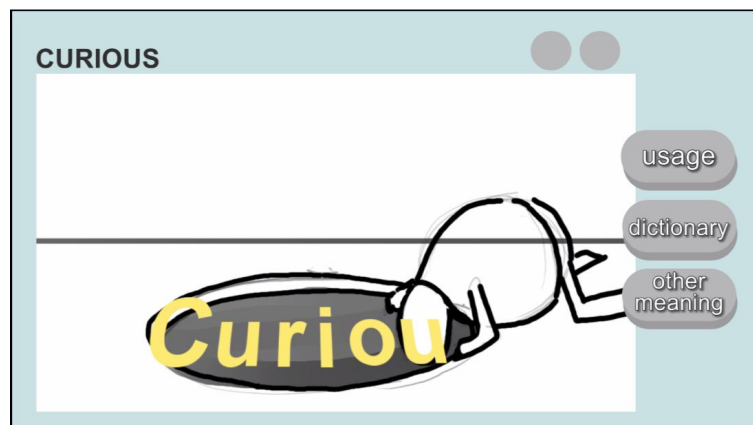
Voice over <'R'>



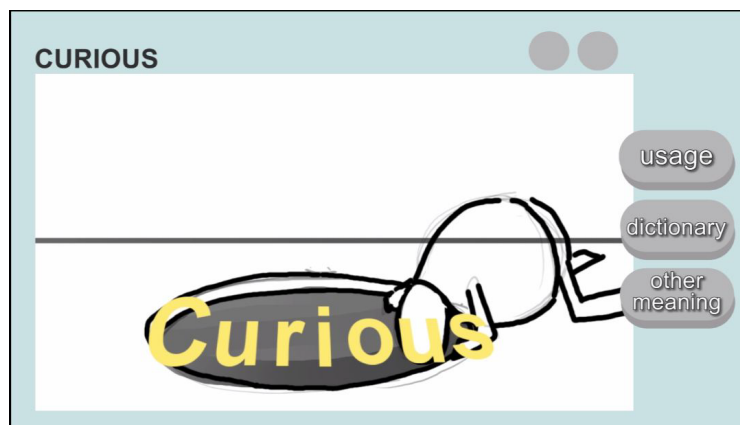
Voice over <'I'>



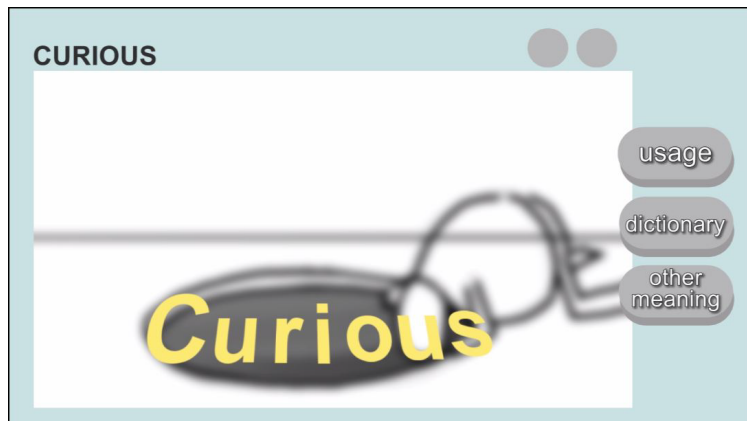
Voice over <'O'>



Voice over <'U'>

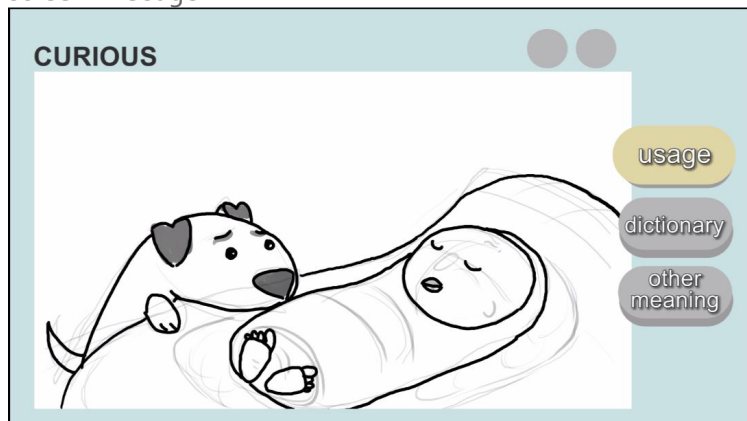


Voice over <'S'>



Voice over <'Curious'>

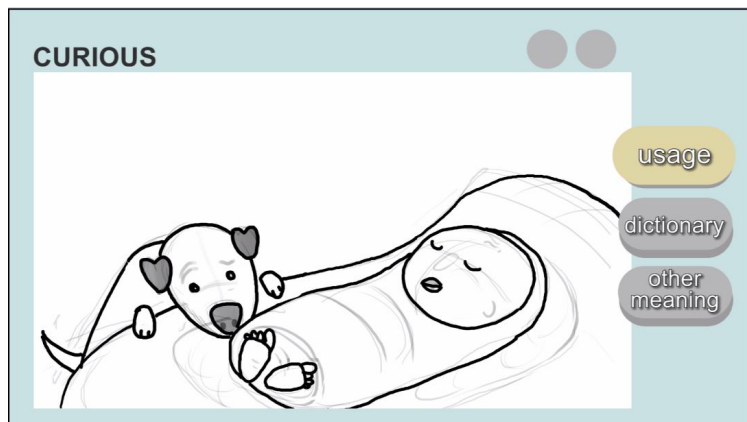
screen 2- Usage



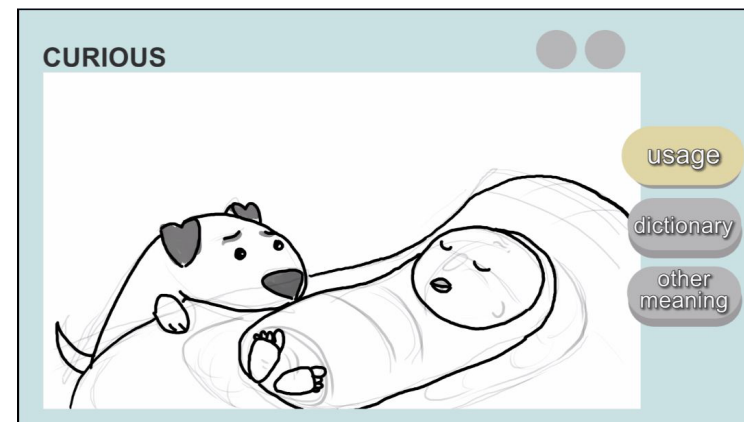
Voice over <'Timmy was'>



Voice over <'Curious to know'>

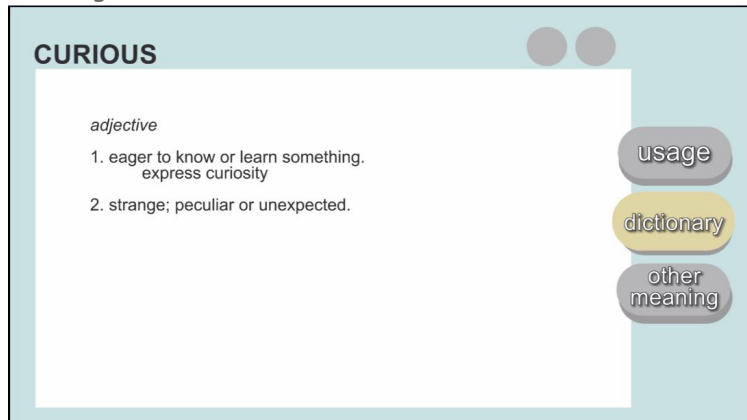


Voice over <'more about '>



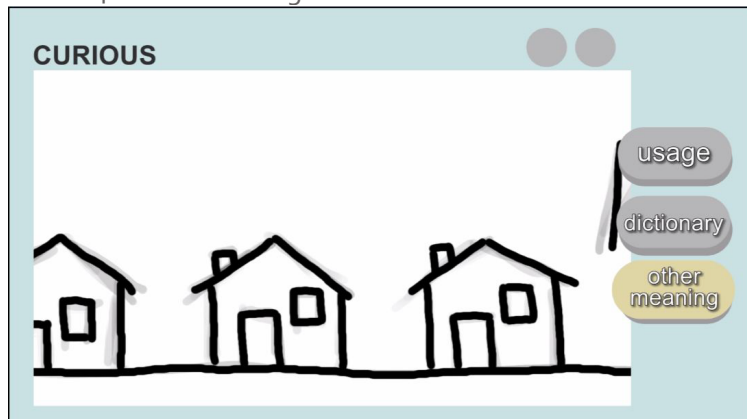
Voice over <'the baby'>

screen 3

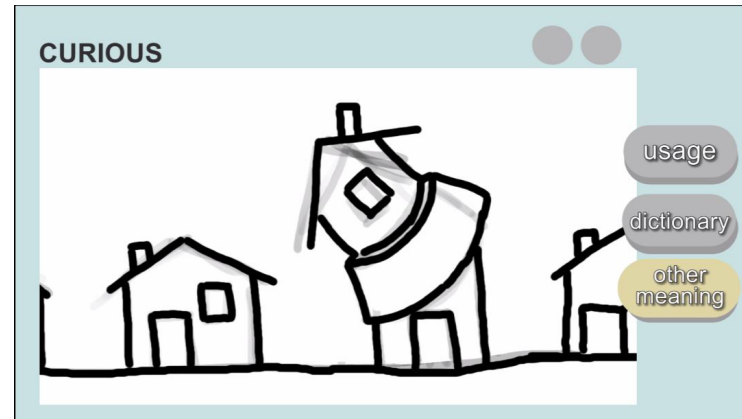


No voice over

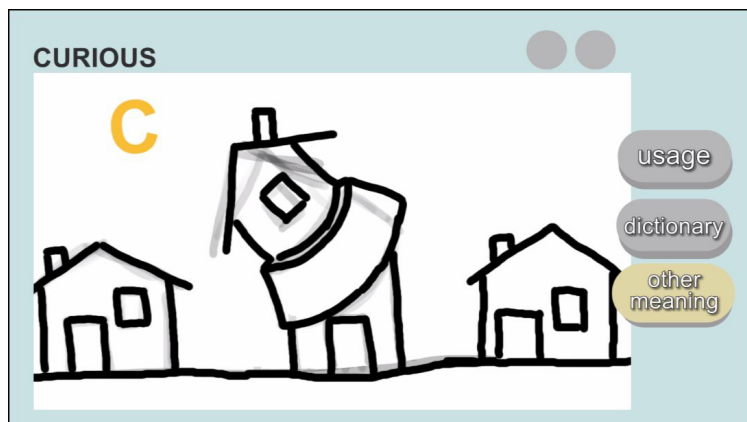
screen 4- other meaning



Voice over <'Something strange...>



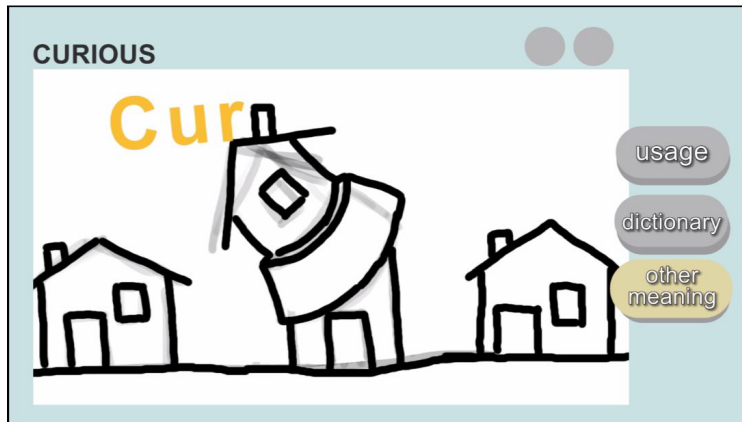
Voice over <'or unusual'>



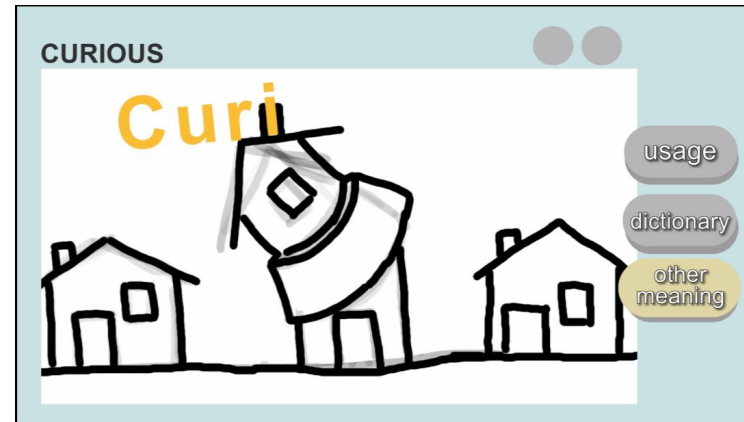
Voice over <'C'>



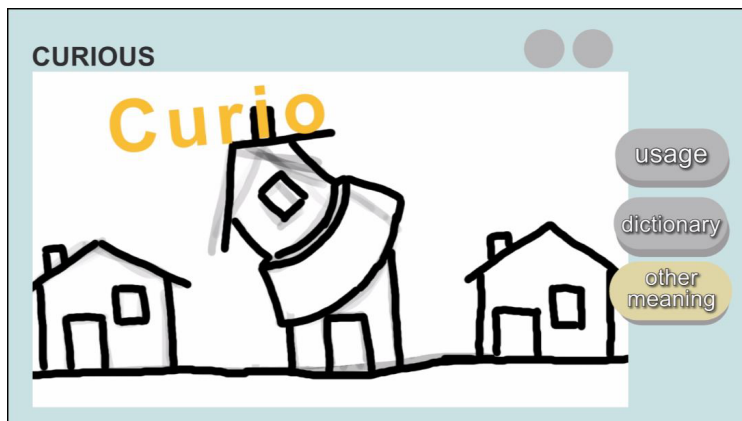
Voice over <'U'>



Voice over <'R'>



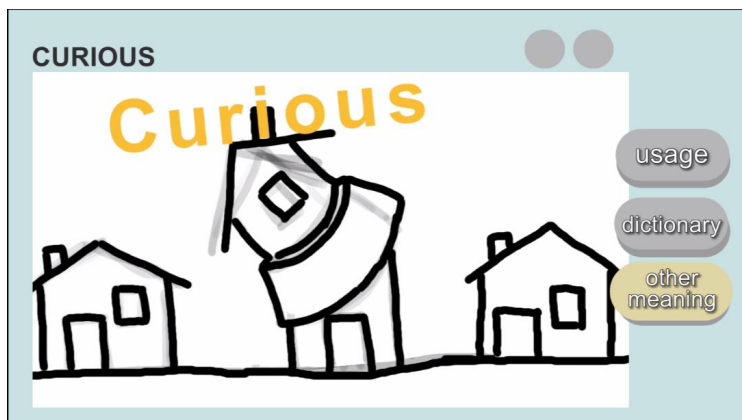
Voice over <'l'>



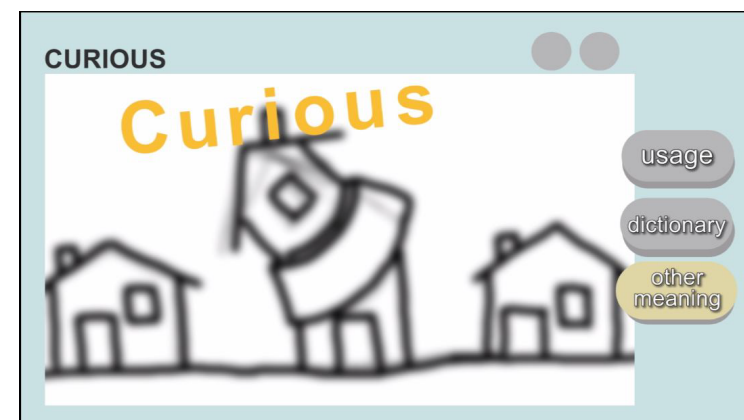
Voice over <'O'>



Voice over <'U'>



Voice over <'S'>



Voice over <'Curious!>



Voice over <'Sam bought'>



Voice over <'a very'>



Voice over <'curious-looking'>



Voice over <'hat'>

## Feedback on Second Sample Mock-up

The feedback for the second version was much better and the interface is more usable now. Both faculty members and LD center folks liked how the whole thing was more visual now. However there were a bunch of things that still needed to be worked upon before the animations could be tested out on kids with dyslexia. I was asked by Prof. Ravi Poovaiah to not to tweak or distort standard typefaces. Ms. Preeti Chowdhry had a similar point when she said that changing the shape of the letters from what they usually look like would further confuse the child about the actual shape of the letter. This made sense to me and gave me the idea of animating the letter themselves as characters instead of using expressive typography- giving them life through animation.

Another thing I got as feedback was that using different sets of animations for the different things is confusing and would increase the cognitive load of a child. Different sets of characters and settings was what I had used in this second mock-up and I agreed with the feedback that this might be too much to take for a child that just wants to understand the spelling of one word. This made me wonder, why at all do I have buttons and other linked videos? All these are increasing the clutter and are confusing. Why shouldn't there be just one video that covers everything? This way there would be no buttons, no different changing sets of animations. So after this feedback I began working on these new ideas to explore them and see how it would be.

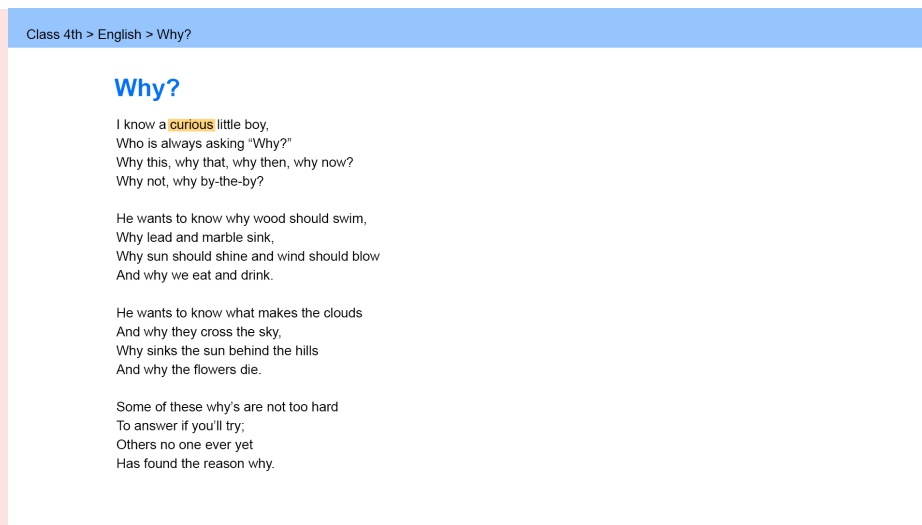
## Second Iteration

Right after the feedback on the last mock-up, I started to make the system even simpler. All the different options have been combined into one new interface that would have the complete lesson. On hovering the mouse on a difficult word, the word would get highlighted and on clicking a new pop up window will open. All extra steps have now been removed, even typing the word (which may have been difficult for a dyslexic) is no longer required as the entire text is already on the screen and simply clicking the desired word would launch the video.

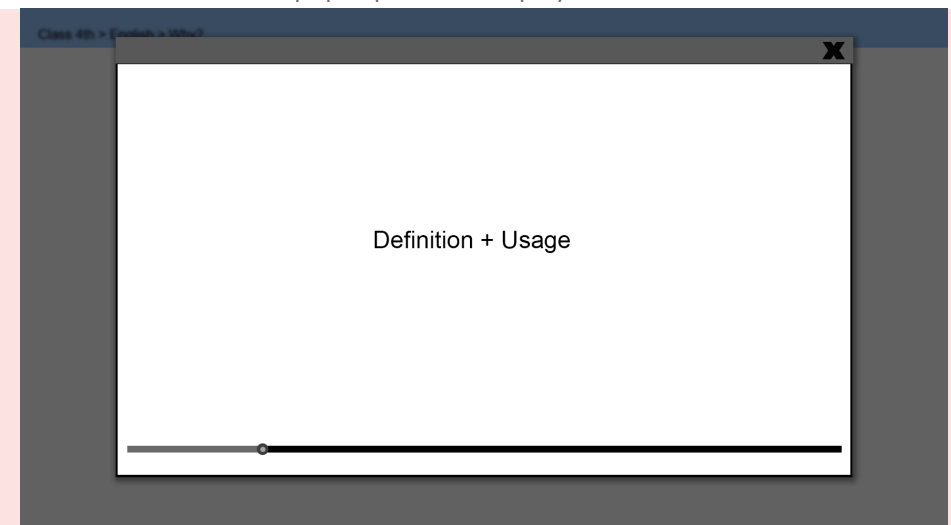
Even the video window is no longer riddled with many options. There is nothing hidden or out of sight. The one video that plays explains everything. There is no need for trial and error anymore and no confusion on reading the distracting option buttons. I have tried to make the whole experience very intuitive and easy for the mind of a dyslexic child to process.

Below is the new wireframe:

screen 1- the entire text of a lesson. Hover mouse on a difficult word

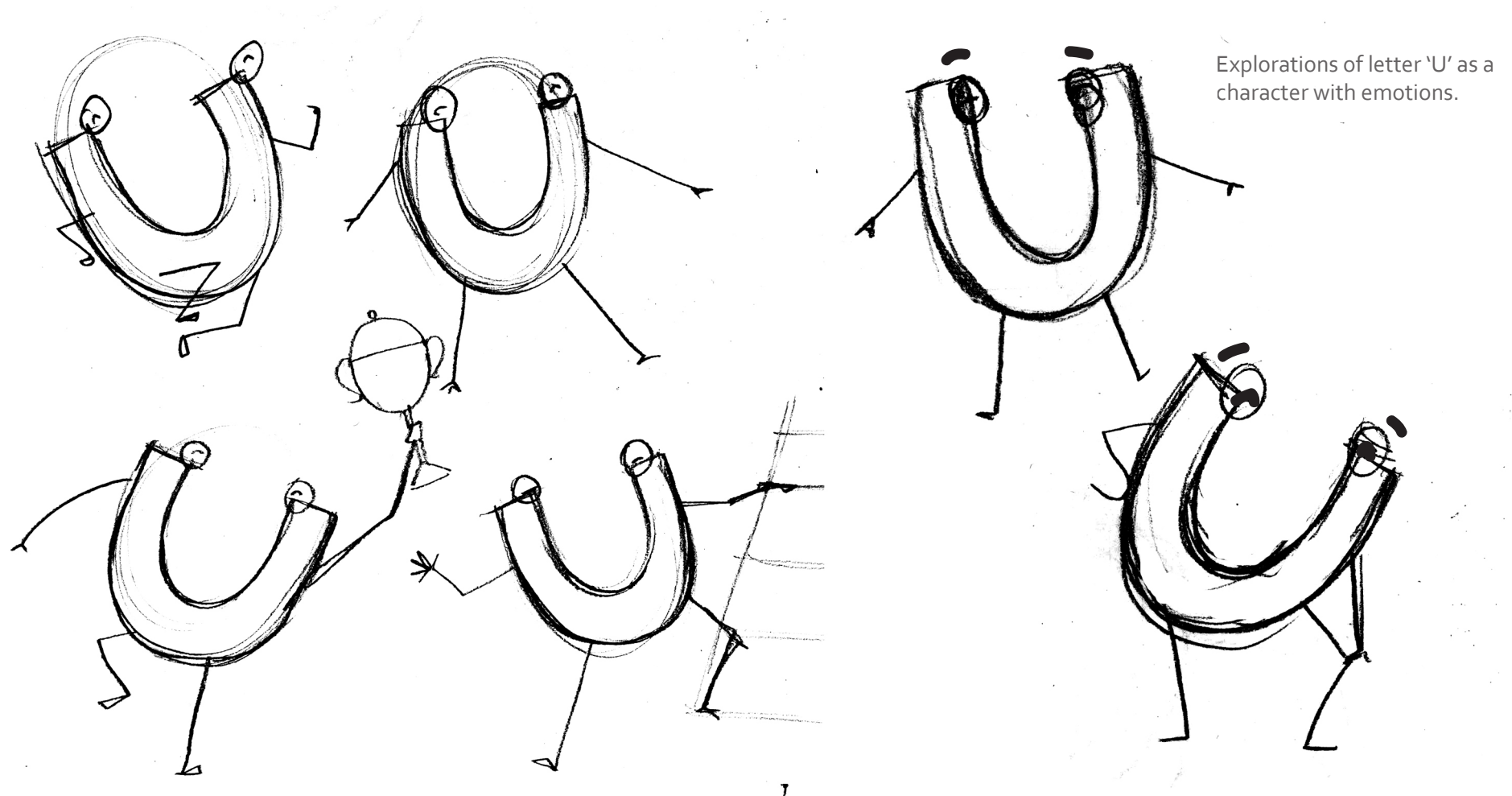


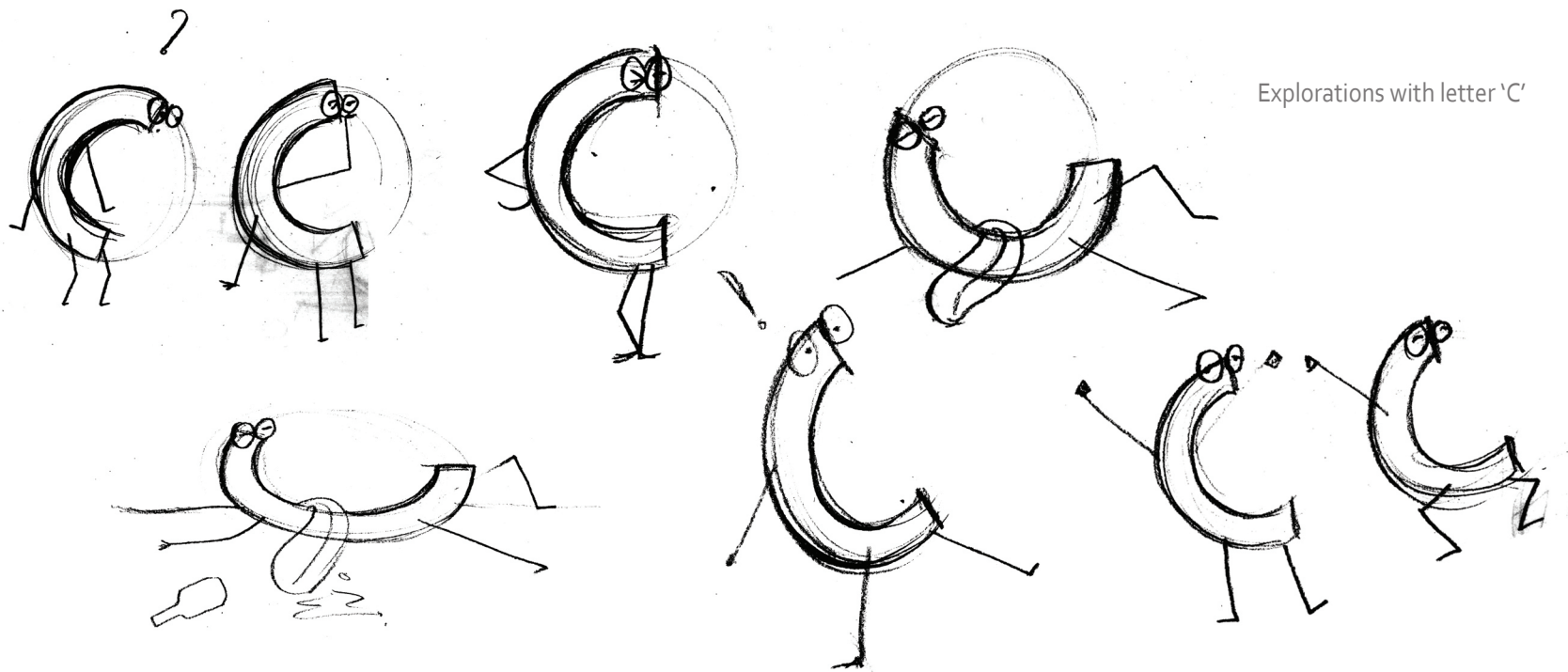
screen 2- new window pops up and video plays



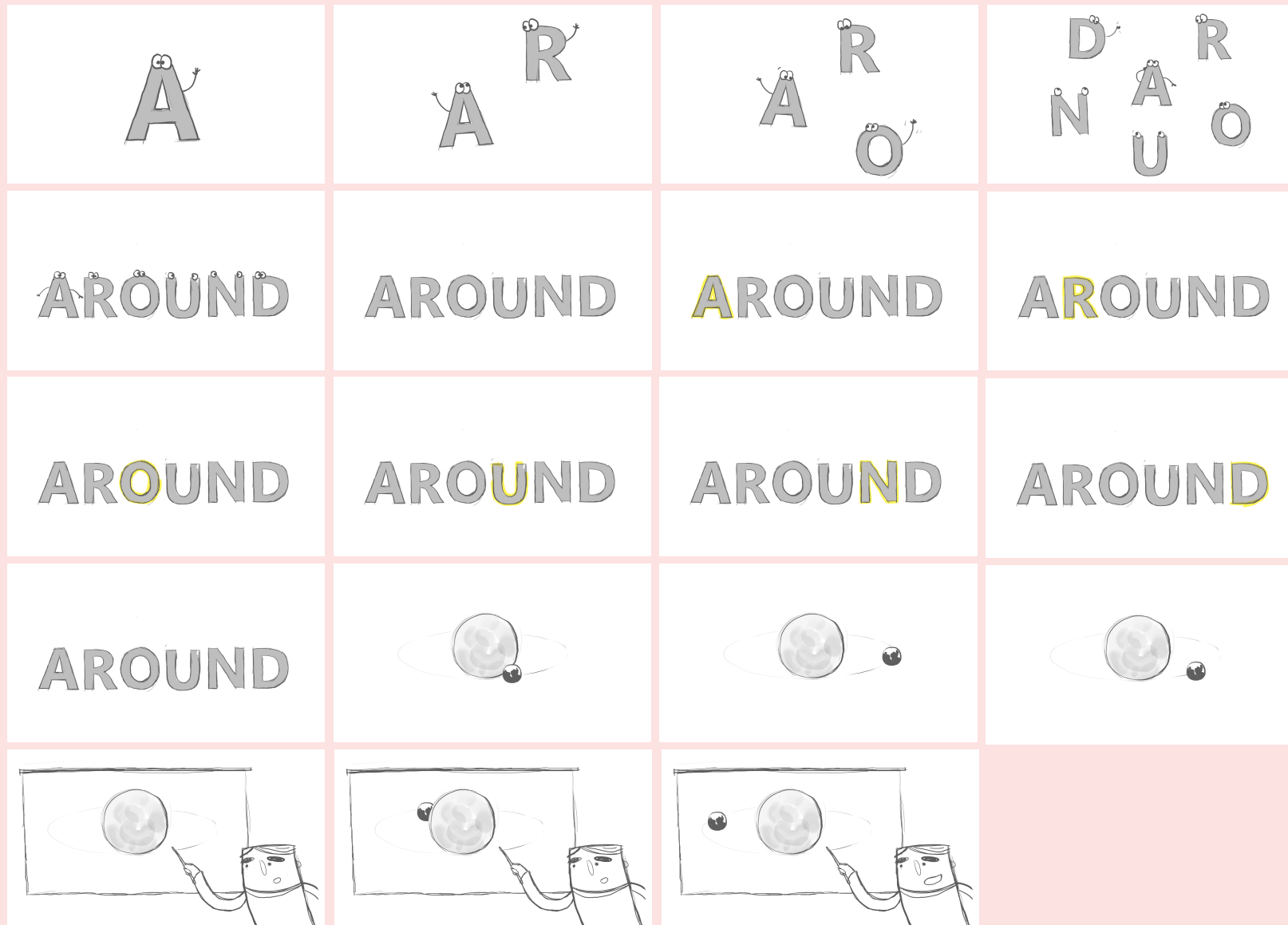
## Explorations

With the latest changes in place, in this version I'm animating text with emotions and actions that explain the word. This way there would be no imagery taking the attention away from the text and the spelling, which is the main point here, will become a character and thus more interesting and memorable. There will be only one character that I would keep same in all the videos. This will decrease the cognitive load of identifying a new character each time and a sense of familiarity and bond will develop between the user and the character.





## Sample Storyboard: For the word 'Around'

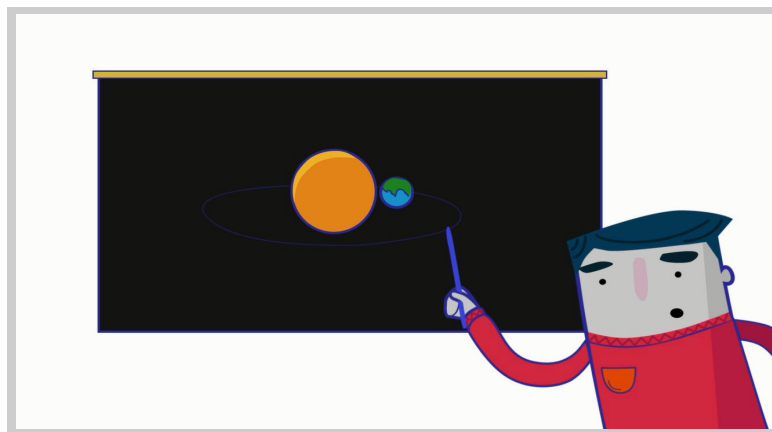


Voice over- 'Around- in a circle or on all sides'.  
The alphabets come in an animated fashion as characters explaining the meaning of the word.

Then they arrange themselves in order and each alphabet gets highlighted one by one as the voice over spells the word out.

Next, the character appears and explains how to use the word in a sentence. 'Example, the Earth circles around the Sun.'

The finished animation  
of the word 'Around'.



## Feedback

The feedback for this version was that it is something very close to finished. I did get some feedback that made me go back to my study and data collection to dig again.

Ms. Veena Basu pointed out to me to use small alphabets instead of all caps as it is less common to find words written in capitals while reading books or magazines etc. and it is important for kids to learn them in smalls, as this is how they teach them. This was something I had witnessed during my visits and study but had not consciously realized, that it was mostly small letters that are taught. So one change was to change the letters from big to small.

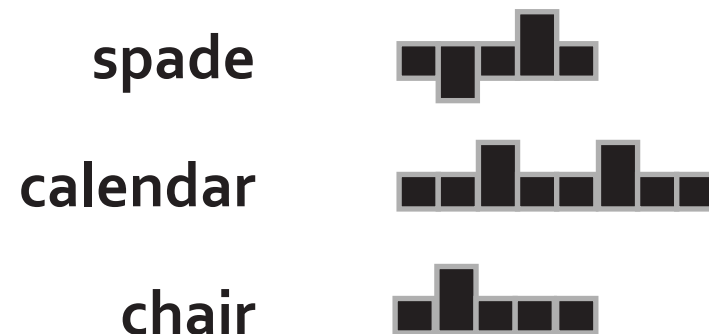
Second was that I needed more substantial visual cues than simply highlighting each alphabet one by one. Since dyslexic children respond better to visual cues, it would help to add more of it to improve the memorability of the word. So this became a task to identify how to engage a dyslexic with more visuals. Another suggestion by faculty member Prof. Sumant Roa sir was to use not just one character, but a set or family so that children could have favorites and remember more easily.

## Third Iteration

For the third iteration, I went through all the previous research and visited the Learning Disability centers again, scouring all the material that they had for teaching spelling. There were several exercises that I found useful and thought of incorporating in my project. There were also several that made very little sense and would probably confuse a child more than help them.

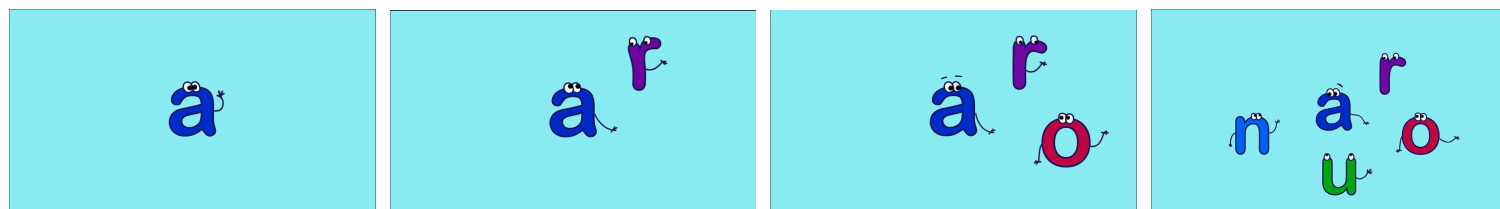
Another thing that I discovered on discussing with the special educators and reading about it was, that teachers in classrooms generally generate a list of difficult words encountered in a lesson and it is naturally assumed that the children can break them into syllables and pronounce them, which is a very difficult task for a child who has a learning disability. So a syllable breakdown seemed like a useful thing to add in memorization of the spelling of a word.

One of the other exercises that I thought would be useful to incorporate was the blocking of the shape of the word. A person who thinks very visually would likely remember the spelling of a word better if the basic shape of the word was explained to him; for a lay person like me, this just seemed an interesting game. Remembering the blocking of a word would help a child recollect not just the shape of the written word but also the order of the individual letters.



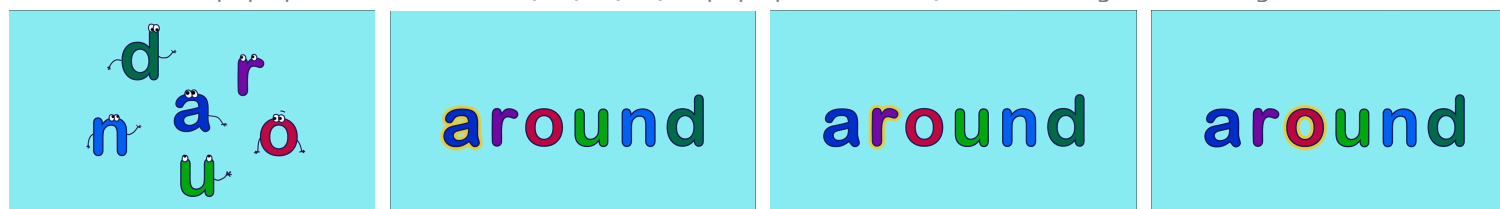
The animation for the third iteration includes the previous alphabet animation and the letters getting highlighted one by one, along with the new additions of syllable breakdown and shape-blocking.

The characters that explain the usage of the word in a sentence are also modified.



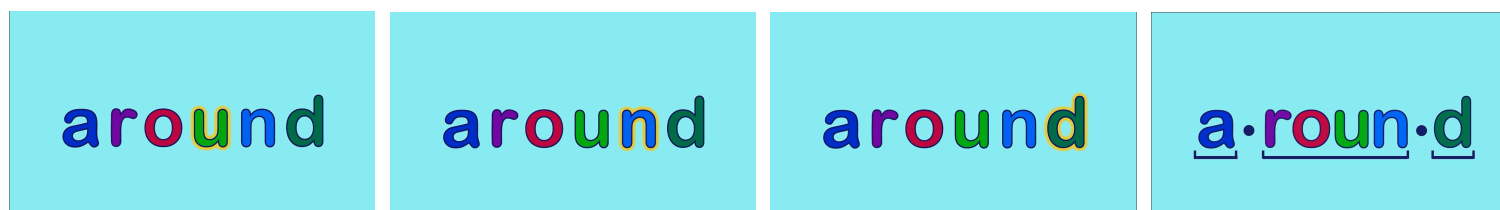
Voice over: 'Around' in a circle, or on all sides.

Action: 'a' would pop up. Then the letters 'r', 'o', 'u', 'n', 'd' pop up around him, thus enacting the meaning.



Voice over: 'a' 'r' 'o' 'u' 'n' 'd'

Action: As the voice over spells out each alphabet, it gets highlighted accordingly.



Voice over: a-roun-d

Action: When the voice over speaks the syllable demarcation, the word gets broken down



Voice over: Around. Example, the Earth circles around the Sun

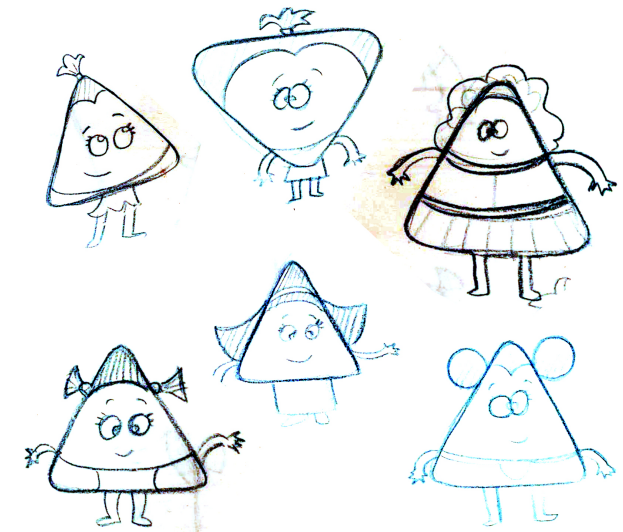
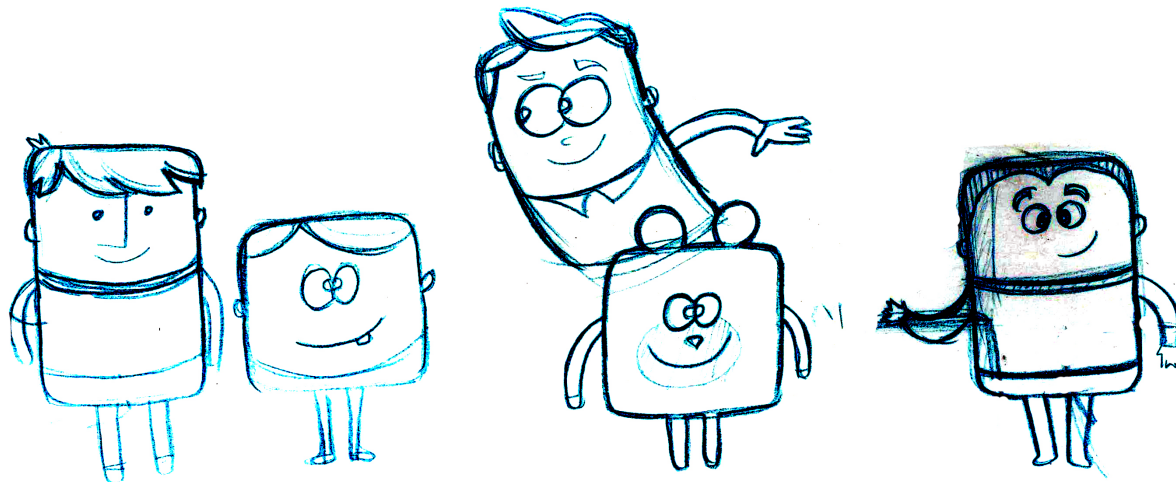
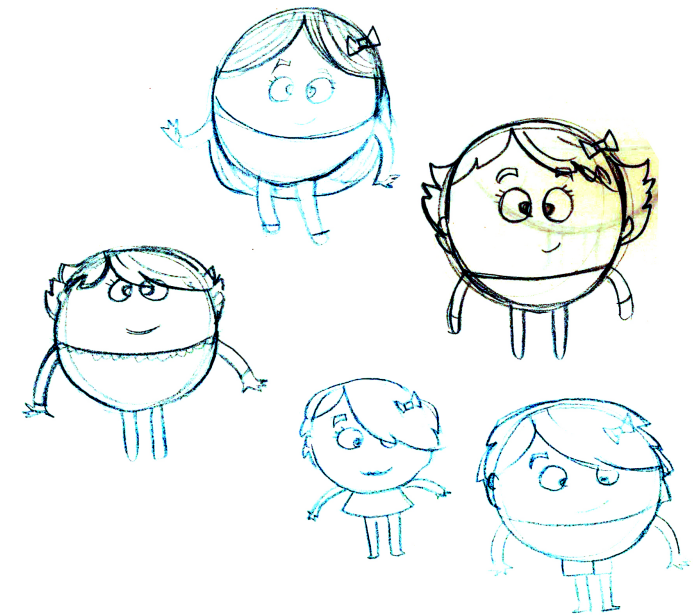
Action: When the VO says 'Around', the blocked shape of the word is shown. When the VO speaks the sentence, the earth is seen going around the sun and the camera zooms out to reveal the character who is standing right there.

# Character Development

Going by the inputs that said that having a set of characters would help the child develop a better bond and have favorites, I decided to introduce three characters, that act like companions to the child in the lessons. Each would have different characteristics and personality so that they could appeal to and be relatable to a wider set of children and different children can develop a liking for different characters. I have attempted to make the characters cute and simple so that a child would look forward to learn things from them.

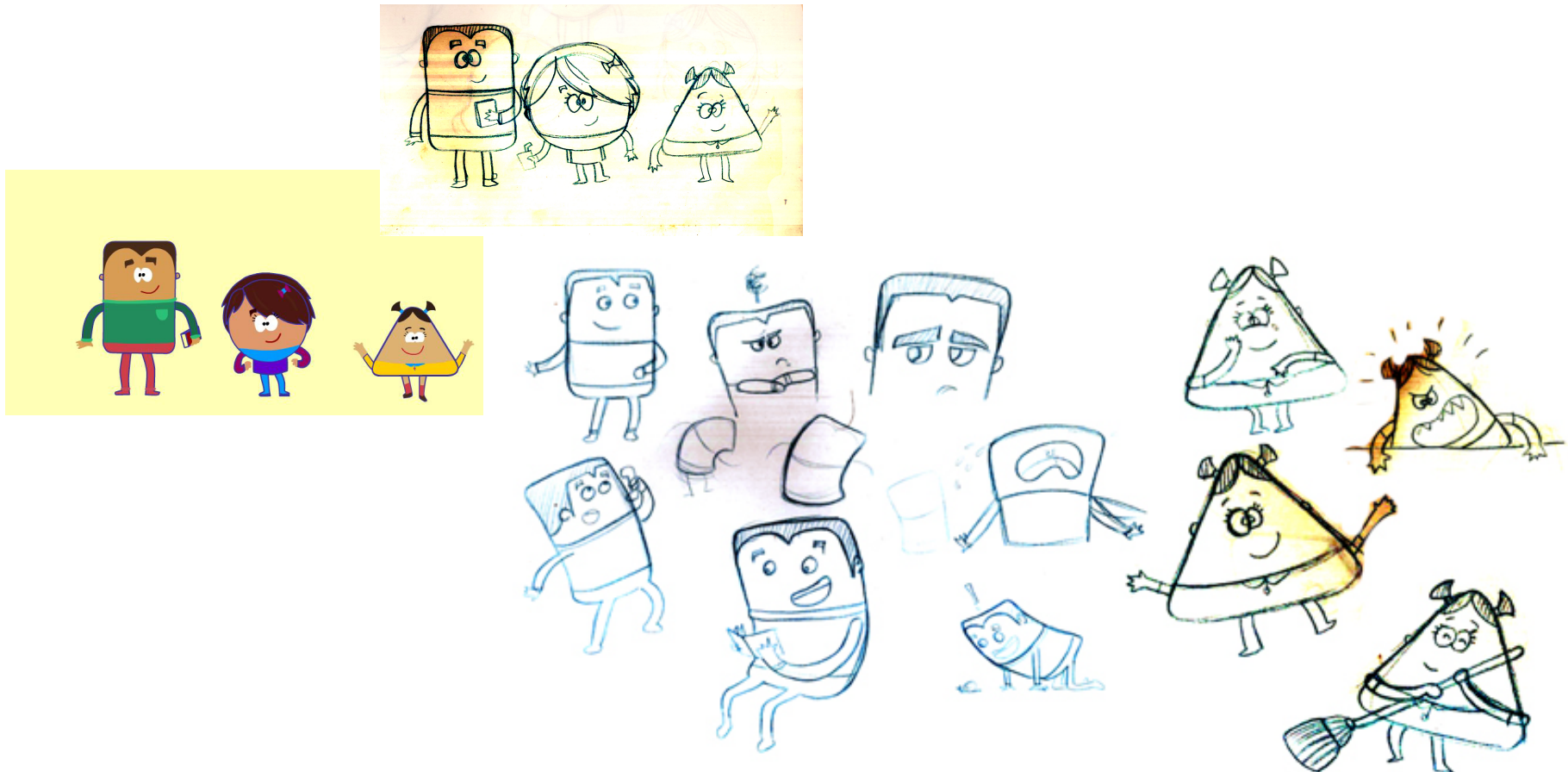
Having the characters angular like the alphabet, made sense so that they don't look out of place with the rest of the word. I had to design the characters like the alphabet, but not confusingly same.

Character explorations out of basic shapes:



# Explorations

The three characters I finally developed are from the three simple shapes of rectangle, circle and a triangle. I've tried to make the characters smart, stylish and sort of role-models for the kids who learn from them. The basic form of the characters would also help the child draw these themselves, if they want. The flat 2D style of the characters makes them faster to animate, helping more words be animated in less time. The first character is Leelu who is an 8 year old boy. He is studious, energetic and respectful. He would be shown as the brainy character of the trio. Second is Tina, who is an 8 year old girl. She is has short hair and is cool and laid back by nature. Last is little 6 year old Mili who is playful and vivacious and is the bubbly kid in the group.



# Final Characters

The final characters are 3 fun-loving kids- Leelu, Tina and Mili. In the animations, they will be seen doing fun and creative activities together or enjoying themselves while studying in school.

## Leelu

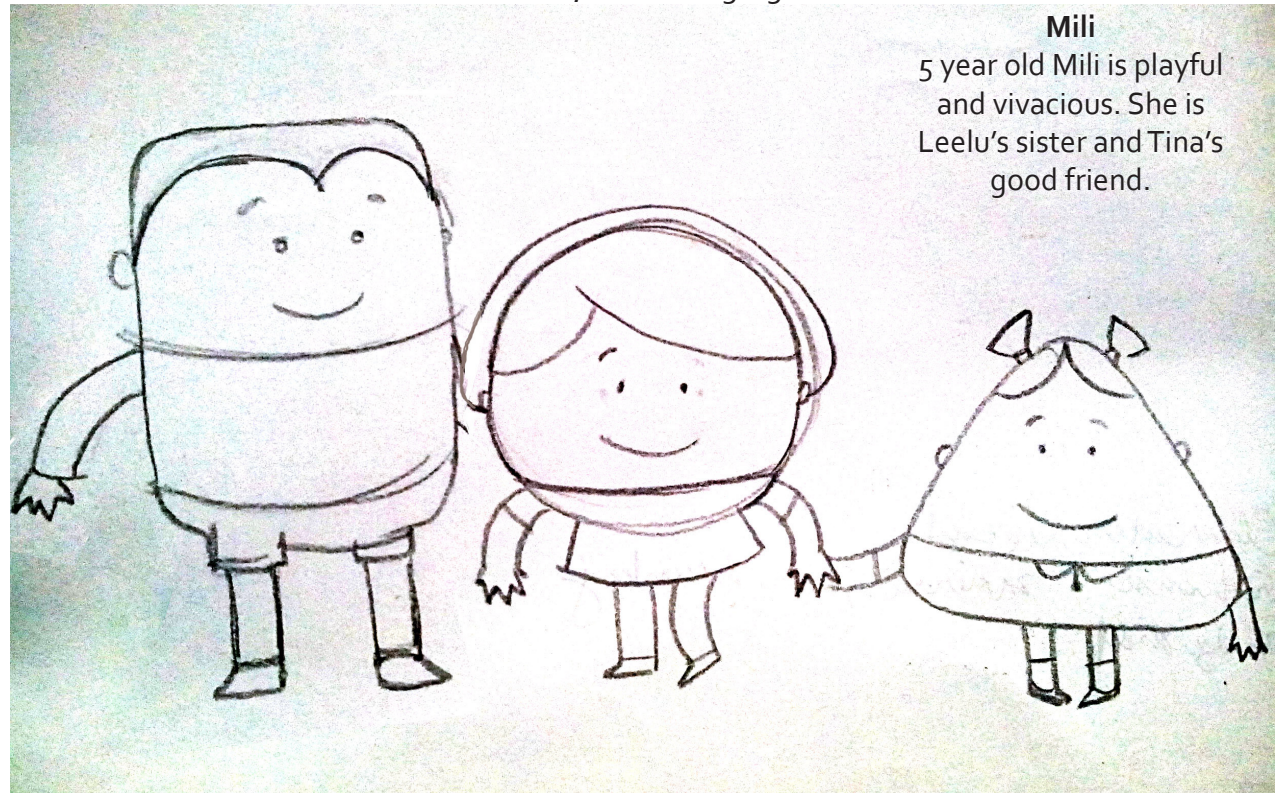
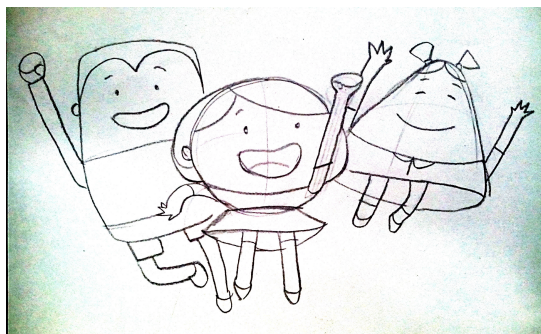
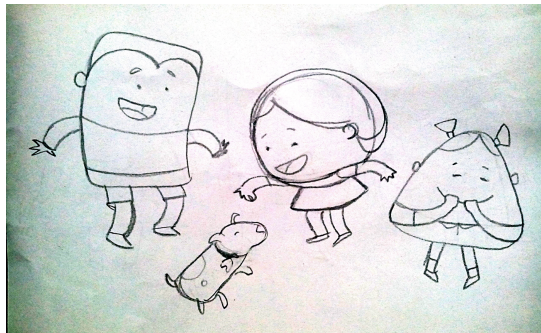
Is a 7 year old boy who is energetic, studious and respectful.

## Tina

Is also 7 years old and is a cool, confident go-getter.

## Mili

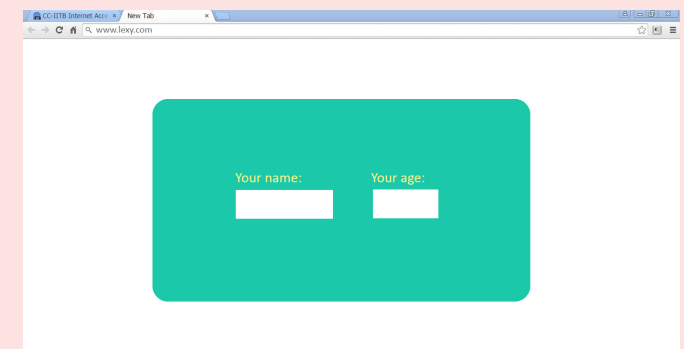
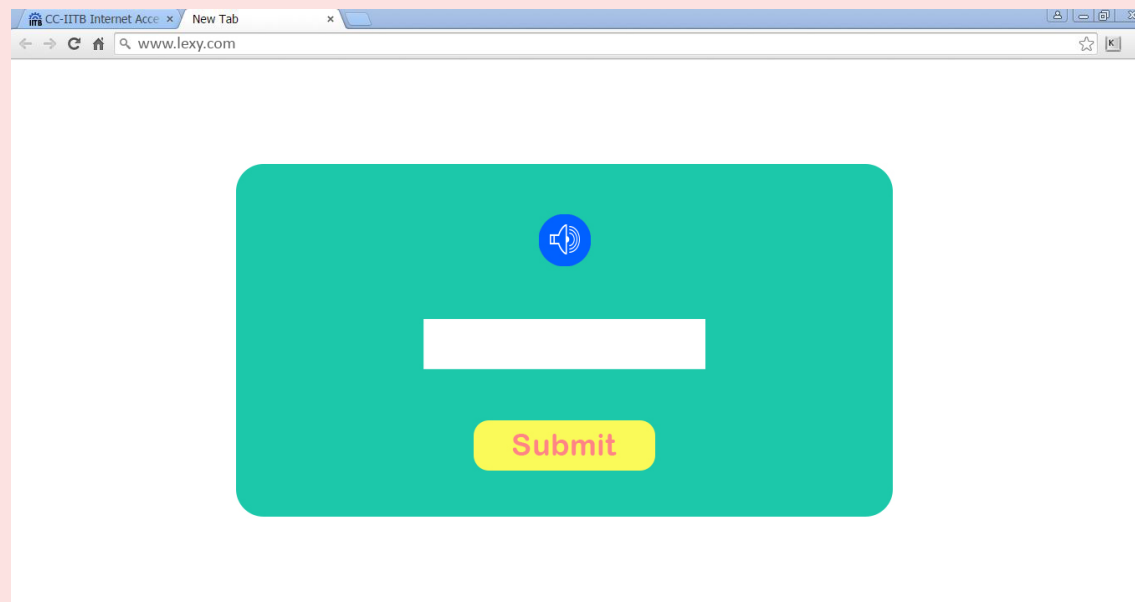
5 year old Mili is playful and vivacious. She is Leelu's sister and Tina's good friend.



# Final Product

The final product is a spelling game called 'Lexy'. Lexia means education in Latin and since this system is aimed at helping children in academics, the relevance of the name is reinforced.

It is a simple dictation test in the form of a mobile-friendly website, that speaks words according to a child's age and the child has to type them on the screen. If the spelling is correct, the test moves forward to the next word, if not, the video with the animated word & its usage gets played on the screen. The child is then prompted to type the spelling again and the process continues.



The first screen asks the child their name and age so that relevant words can be pulled up from the database.

The second one would have the simple, distraction-free UI of listening to the audio, typing the word and pressing submit.

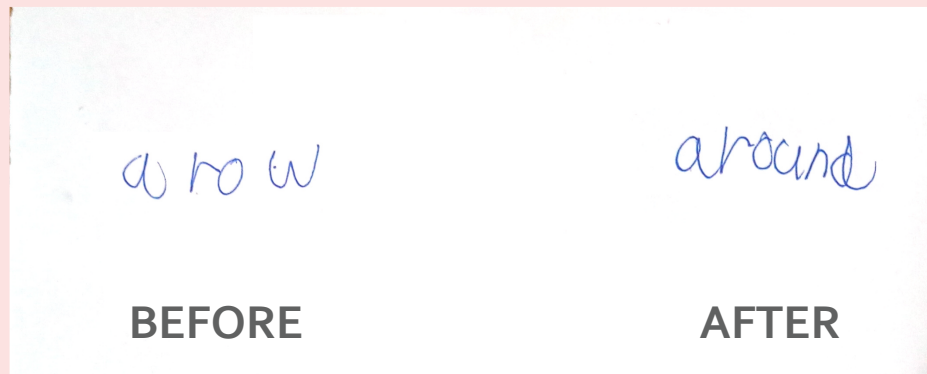
# Evaluation

For evaluation of the individual animations, I frequented the Verve center several times getting in touch with the disabled and other learning disabled children between ages of 5 to 9. One interesting thing that I observed was that the age-groups created according to word difficulty by Dolch & others, don't apply to the Indian scenario as the level of classroom studies already makes the children well-versed with words that should be ahead of their age according to these reading lists developed internationally. I had to shift my focus from 8 year olds to approximately 6-7 year olds with the reading list that I had chosen.



I evaluated the system with criteria like how well the child reproduced the spelling after watching the videos; how well they remembered the spelling after 15 minutes of watching the videos; could they reproduce the spelling better orally or written; whether they found the visuals appealing and if they could use the word now in a sentence of their own.

Majority of kids older than 8 already knew the correct spellings of the words. But kids less than 7 year of age were at the level where they were struggling not only with writing the correct spelling, but also with the construction of the letters themselves. In these cases the videos were of great help and with at least one watch the kids were able to draw the letters correctly even if they missed out a letter from the spelling occasionally. Interestingly, at least two children could not write down the correct spelling even after watching the video but they could orally recite the spelling correctly. This coincides with the earlier observations that dyslexic children prefer and respond better to oral methods of teaching. They responded well to the visuals as well and showed general interest in the characters.



Written by 6 year old  
Aafiya at Verve.



## Future Scope & Conclusion

Ultimately, the goal of my project is to make the dyslexic child comfortable with old arch enemies of spelling and comprehension by translating and intertwining the words into the dyslexic's language of visuals. It could help a dyslexic child self-study after school or enable a parent to home-tutor their child. To help a child remember the spelling of the words they could not even pronounce or comprehend correctly previously, should be the final and fulfilling result of this project.

This project is a mine of future scope for new and better projects. I see a scope of expanding the current list of words from only one list to all the difficult words from the school subjects that are taught in English and that might have words new and difficult for the dyslexic child. Furthermore, other classes could be included too. The project can be expanded to an extent that the entire school curriculum becomes an interesting audio-visual film, benefiting not only the students with learning disabilities but also making the dull routine of school colourful and engaging for the other kids as well.

The exercises that are usually provided at the end of each lesson in a book could be programmed into a game that makes learning even more enjoyable and does away with the intimidating system of exams. But throughout, the heart of the project would remain the same - to help dyslexic children dread school less and be able to rise and be appreciated for the intelligent and bright beings that they are.

# References

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[www.learningspy.co.uk](http://www.learningspy.co.uk)  
[www.nclld.org](http://www.nclld.org)  
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## Papers

'Managing Specific Learning Disability in Schools in India'  
by Sunil Karande, Rukshana Sholapurwala and Mudhury kulkarni

'Impact of Computer Aided Learning on Children With Specific Learning Disabilities'  
study carried out by The Spastics Society of Karnataka

'Learning Disabilities'  
by Marita Adam, with contributions from Samrudhi Bambolkar, Nadia C. Fernandes, Ritwika Srivastav, M.E. Yeolekar and Madhuri Kulkarni

'Learning Disabilities in Children's and Adolescent Literature. How Are Characters Portrayed?'  
by Mary Ann Prater

## Books

'How to Detect and Manage Dyslexia' by Philomena Ott  
'Sixth Grade Can Really Kill You' by Barthe DeClements  
'Dying to Know You' By Aiden Chambers  
'How to Spell Perfect' by Ronald Rideout