LEARNING AID FOR DYSLEXIC CHILDREN

Understanding the world of dyslexic children and ensuring growth in reading ability and confidence through design intervention.

Project 3 | Interaction Design

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Degree Project

Learning aid for Dyslexic Children

Approval Sheet

The project titled 'Leaning aid for Dyslexic Children ' by Naveen Singh Rawat, roll no - 146330011 is approved for partial fulfilment of the requirement for the degree of 'Master of Design' in Interaction Design at IDC School of Design, IIT Bombay.

Guide: .....

Chairperson: .....

Internal Examiner: .....

External Examiner: .....

15-06-2017

Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission.

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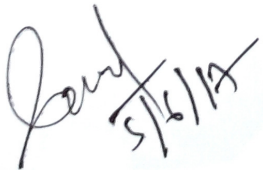

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Acknowledgement

This project would not have been possible without the support and efforts of several people I met while working on this project. I take this opportunity to express my sincere gratitude to my guide Prof. Ravi Poovaiah for his patient counsel, immense support and guidance throughout the course of the project. His encouragement and invaluable feedbacks kept me working towards my goal. I'm also thankful to Prof. Venkatesh Rajamanickam, Prof. Anirudha Joshi, Prof, Girish Dalvi and Prof. Jayesh Pillai and Ms. Sudha for their invaluable feedback and guidance.

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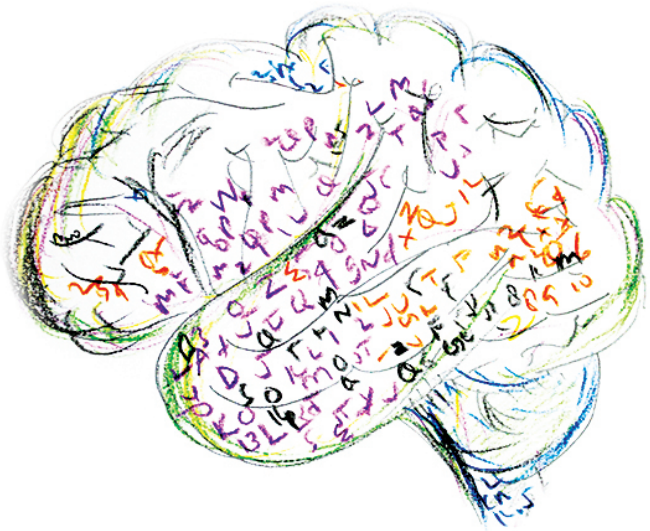
Thanks to my peers for their support and suggestions which helped me alot in my research.

My family for all their love and support.



Content

Abstract

As per Jan 22, 2013, there were 228,994,454 students enrolled in recognized schools in India and it is believed that 15% of the total enrolled student are dyslexics, which brings our count of dyslexic Indian children to nearly 35 million[1]. Dyslexia is the most common type of learning disability that affects one in every five children and creates major difficulties in learning to read, spell and write correctly. Struggle in distinguishing alphabets, words and learning of the connections between written letter patterns and their sounds leads to poor reading and learning at school. Such children try to avoid school time and any confrontation that involves reading. They are labelled as ‘dumb‘ or ‘stupid’ when they actually have average or above average IQ and some are even gifted.

Social stigma of a learning disability often prevents parents from seeking appropriate remedies for children with dyslexia that can actually help their children[2]. Struggling to keep in with the progress of the class such children are labelled as slow learners or dumb. This is where the first strike of dyslexia starts bringing major negative impact that continues to unfold for a long time. Such children are promoted without special attention till their first public exam, class 10th and the issues starts snowballing. This is especially troubling as early early childhood and primary education is very crucial in long term success. A proper directed education for such children in these early years helps in building foundation skills to cope with there difficulty that affects the rest of their learning and lives.

Here I have attempted to deal with this learning issues considering the barriers the child has due to low confidence and direct instruction based teaching at school. I have put together a system to develop interactive applications that directs focus on phonological deficit in dyslexics. I have followed the approach to build letter-sound relationship through engagement and positive reinforcement.

Key insights were derived from long interviews and sessions with educators, children and psychologists at multiple places in Mumbai as a part of extensive user studies.

This project has revolved around children and kept them center to all design process stages for testiing prototypes to taking feedback. Here a child is using my early prototypes. I created prototypes to materialise my intial concepts to see them in action to get more richer feedback at intermediate phases before rolliing out an extensive refined one.

Major part of concept, prototype testing and feedback sessions took place at Verve centre. Verve is a multi-modal Center in Mumbai which focuse on remedial education for children with learning disorders.

The project hypothesizes, as it takes a long time for early dyslexic readers to understand alphabets and make words from them, a) focus has to be on sensory based applications that reinforce learning through action and ,b) assimilating such learning aids in remedial education environment would add value to dyslexic teaching as it will reduce the time taken to help child reach reading fluency of grade level.

If proven, this approach can be scaled and incorporated in learning environment across learning centres,homes and schools where such children can practice on thier own and become better learners.

Introduction

Dyslexia is a specific learning disorder which affects the person's ability to understand decode letters, read and spell correctly. However this is not a sign of low IQ or intelligence. Dyslexic person sees the letter as normal people do but their brain has to exert more processing in decoding this information.

"Dyslexia is a brain-based type of learning disability that specifically impairs a person's ability to read. These individuals typically read at levels significantly lower than expected despite having normal intelligence. Although the disorder varies from person to person, common characteristics among people with dyslexia are difficulty with spelling, phonological processing (the manipulation of sounds), and/or rapid visual-verbal responding"[3].

As I mentioned Dyslexia is not a sign of poor intelligence or laziness. It is also not the result of impaired vision. Children and adults with dyslexia have a neurological disorder that causes their brains to process and interpret information differently which can also make it difficult for people to express themselves clearly. It can be hard for them to use vocabulary and to structure their thoughts during conversation. Others struggle to understand when people speak to them as their brain is working too hard to process the sounds of the words and draw meaning.

Some call dyslexia a gift. Dr. Maryanne Wolf of Tufts University, USA published an article on dyslexia and creativity in which she mentions that dyslexics become more expert in perceptive and creative skills, especially in artistic word. Dyslexic brains are more creative in their approach. My research focuses on this aspect further into this project.

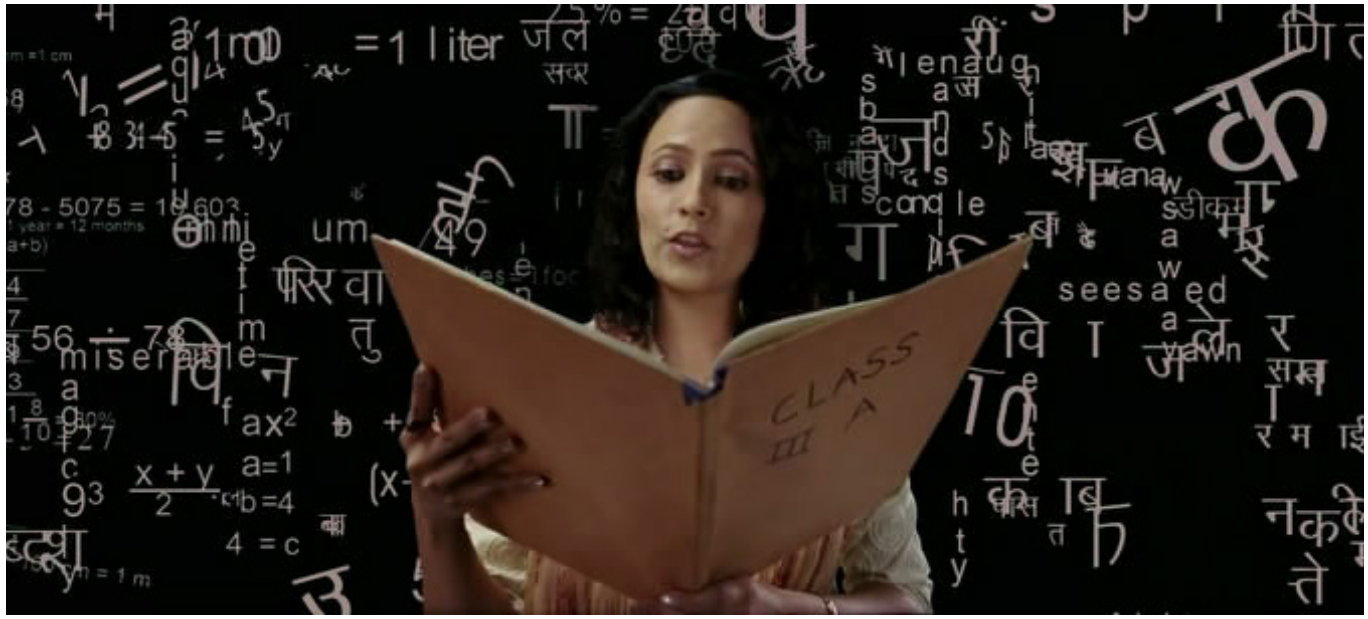
Its quite amusing to know that there are children who lag behind in school just because their learning behaviour is different than the average kid, despite having average and above average intelligence.

Dyslexia is often called a ‘hidden‘ problem. It makes an otherwise intelligent person to struggle in basic reading and comprehension. It comes under the umbrella of Specific learning disability or SpLD that is a subset of learnin disability. Children with SpLD fail to achieve school grades at a levels, undetected this leads to chronic poor school performance and even school drop-out. Spelling mistakes, illegible handwriting with poor sequencing of letters or numbers, inability to perform simple mathematical calculations correctly are the main hall marks of this life-long condition.

It is well established that dyslexia does not affect any other scenarios of learning abilities or intelligence. One can not make out a dyslexic in a class and they appear as normal as they are already trying too hard to cope.

Research shows that a dyslexic brain uses parts of right brain that are not reserved for reading and thus the approach becomes difficult in reading phonemes. It should be understood that dyslexic brain existed much before a reading brain existed. This brain has a different organisation of a brain that has been here even long before reading occured.

But It is very much possible for the dyslexics to read, spell and comprehend. We all can speak naturally but reading comes as an acquired skill. We are not born with it. Dyslexic brain has been here well before we had language or any script. In this project I aim to understand this brain and the young ones in the middle of all of this.

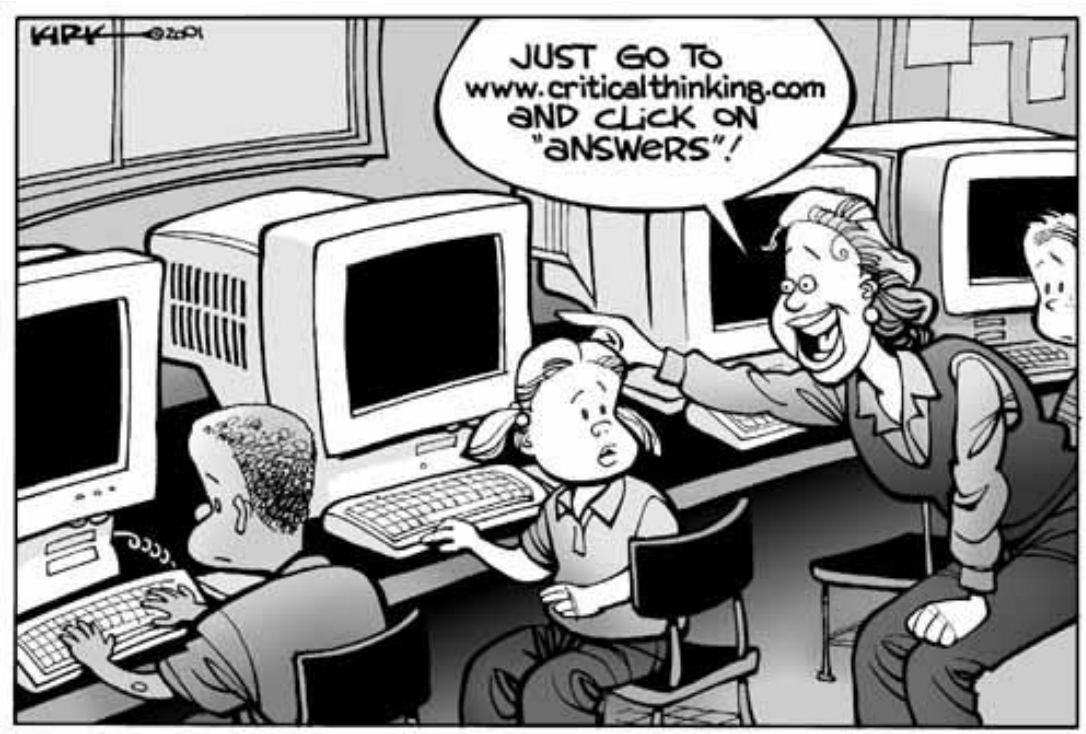


Still from the movie Taaren Zameen par that revolves around dyslexia in Indian scenario and the social stigma attached to it

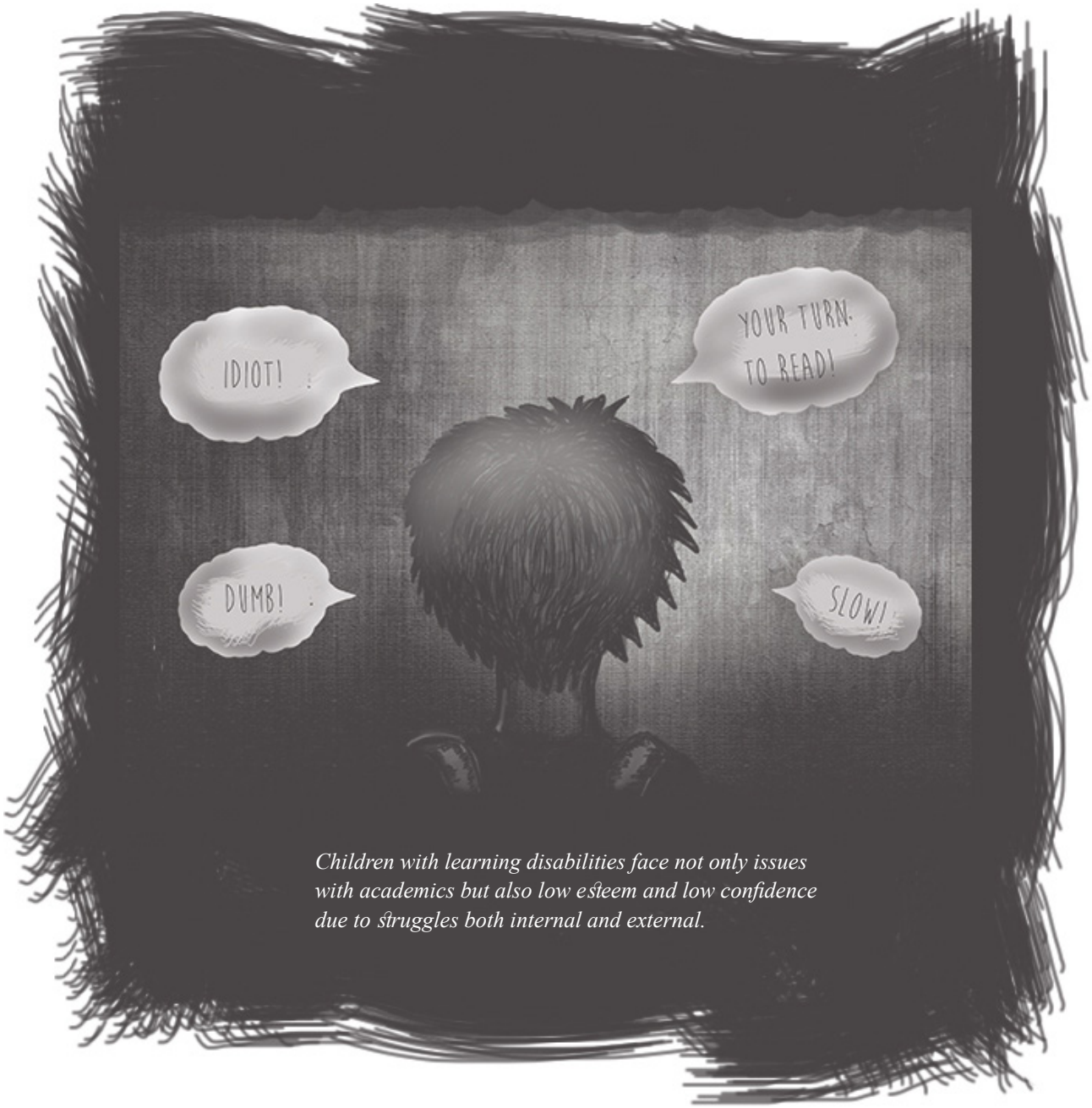
The project unfolded with a goal of not establishing a entirely new system but rather an intervention to examine how better things can become. Several ideas sprung as I utilised insights from my user research. I made an attempt to bridge the gap that widens more an more as the dyslexic becomes more alienated to reading and becomes a failure in academics. I laid down design considerations to build a framework through which digital learning aid will be benefitial in a special learning environment that is encouraging, productive and is based on positive reinforcement.

A great chunk of time was spent in user studies with an aim to narrow down focus and scope to better address specific issues and then scale up from there with a concrete direction. The target user group for this project are dyslexics who are early readers/ emergent readers (age 5-8/class1-3)and are at the point of building their langauage basics.

The teaching methods analysed are prevalent based on strengthening english reading.



Its hard to decode words and comprehend for dyslexics
image source : dyslexiauntied.blogspot.in



Children with learning disabilities face not only issues with academics but also low esteem and low confidence due to struggles both internal and external.

Motivation

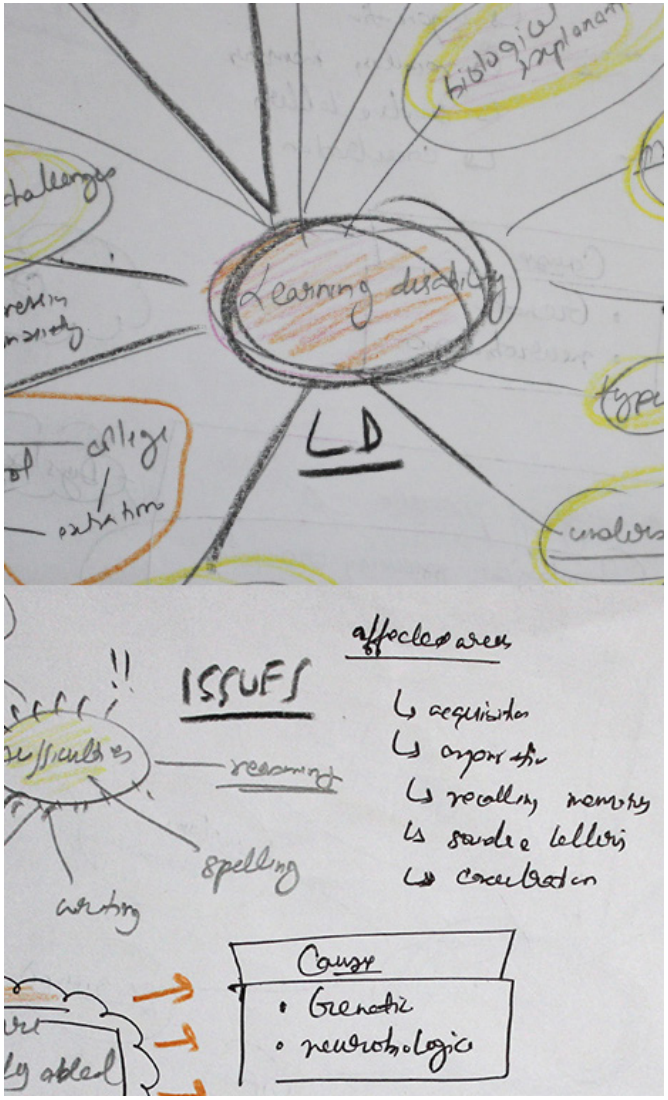
Last year I volunteered with an NGO that provides therapy and special aid to children with developmental disabilities. I observed children with developmental delay very closely and witneesed the support and encouragement they need to function and be a part of society. I spent whole days with them and observed their world. I saw the power of early intervention and the benefits that help such children live a healthy and dignified life. I observed the special teachers built on individual strengths of children and tried for an inclusive class.

That experience left a a heavy imprint on my mind and interest on questions on how learning issues affect children in our country. This was when I stumbled on dyslexia and after than didn't look back. It is painful to see children struggling with the very basics of reading, writing and spelling when they are equally intelligent as their peers.

I decided to ask more questions, understand their learning system and attempt to make it better, may be a big change or small but valuable and dedicated.

> **Tell me and I'll forget; show me and I may remember; involve me and I'll understand."**

- Chinese proverb



Design Process

A large part of process involved iterative user studies in addition with secondary research. This project revolves around participation from educators and children from initial stages. Remedial learning sessions were observed as neutral participants and long interviews were held with educators, organisations and child psychologist on different intervals to recheck and iterate on my notes and feedback data. Data was collected and then an understanding of the context, environment and design goals were drawn out by analysing the content.

1. Background Study

Study and literature review of work so far in the areas of learning disability and teaching methods. User studies were initiated along with background study by visiting organisations and special education centres involved in this domain. Existing medium of instructions were studies to create context for system and interaction design for the final concept.

Iterative User Studies

User studies were conducted to identify the potential sites of design interventions for dyslexic children. The aim was to study behaviour of children and their response to the teaching methods followed at learning centres in India. Interviews were partially structured and were audio recoreded to later cater to any biases generated. Partipatory sessions were held. This helped in gaining trust of both educators and children and resulted in better insights on how and where the children are actually struggling.

Analysis

With the user studies and secondary study data, content analysis was done and key insights with design opportunities were generated.

Ideation

Exploration of multiple concepts and ideas based on the insights generated from previous studies. Rapid prototypes were created and tested.

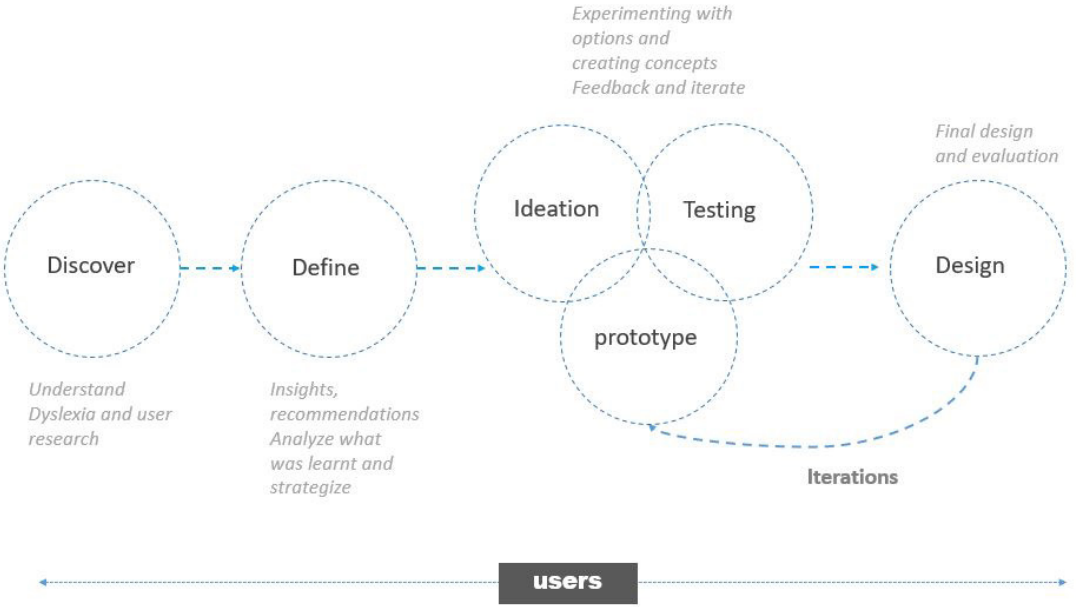
Concepts were converted into soft prototypes and tested with children with iterations. Of the ideas, the ones based on engagement and repetition was selected for further detailing.

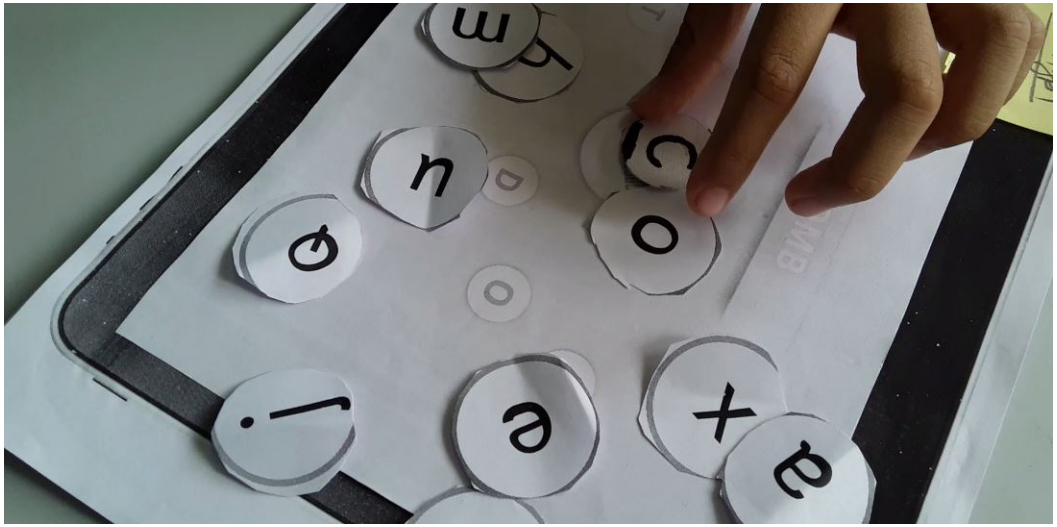
Final Design

A Detailed design combining learning tasks with engaging and interactive content was created. The prototype was then used to validate the proposed concept.

Evaluation and Findings

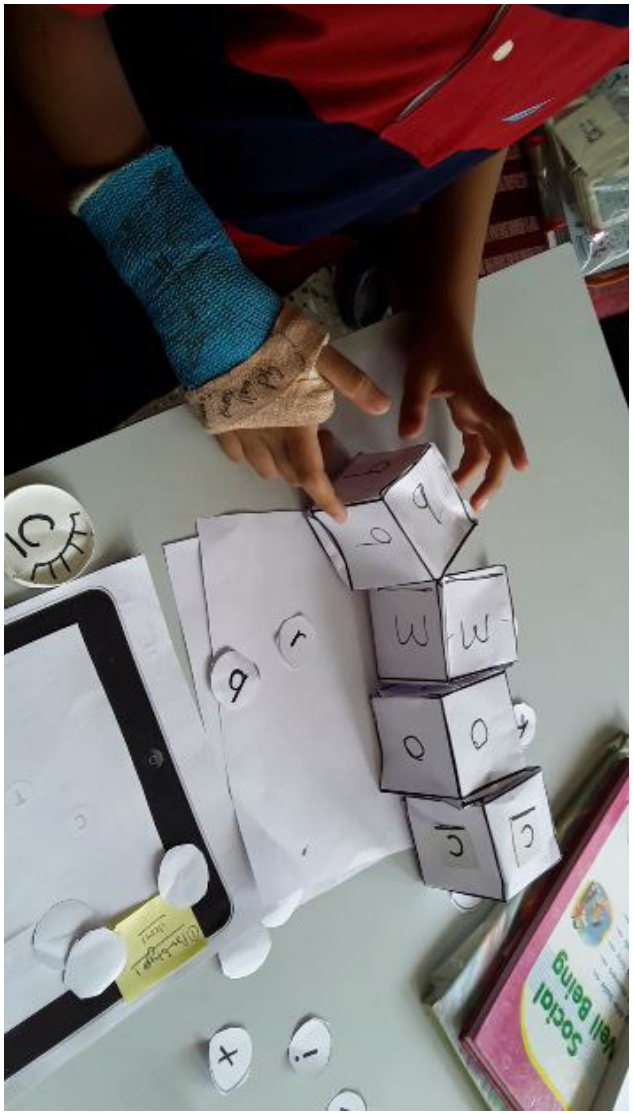
The initial mock-ups were evaluated with the educators and children during the project process. The final prototype was evaluated with targeted users and findings were used to improve the concept and the final prototype. Multiple iterations of the design and prototype were used during the evaluation process





Top : Design process flow chart.

Bottom: Rapid prototypinf helped me a lot in directing focus and refining my concepts and evaluating the design with children and teachers.



Field study, interview, observation sessions, participant during sessions. Here a child is using my a paper prototype during intermediate stages.

User Studies

Understanding and setting context through extensive user studies

In this section I will describe my meetings with professionals, doctors and teacher in the field of dyslexia. Since the early onset of the project I frequented Verve centre which provides remedial education along with occupational therapy to children with dyslexia and other learning disabilities. The focus of my investigation has been to observe and understand the teaching environment through empathy and participatory process with regular feedback sessions.

The approach consists of long interviews and one to one sessions with children affected by dyslexia across age group 5-8 years. To understand wider scenarios organisations like MDA(Maharashtra Dyslexia Association) which have been working in this filed for more than 20 years were also approached.

To understand assessment methods learning disability clinic at KEM hospital, Mumbai was visited and interviews were conducted.

The consolidated observations from secondary and primary research culminated into deeper insight into the struggles of dyslexics .

The sessions at verve centre continued parallel with ideation, finalisation of design concept, soft prototyping, design, development. Part of Evaluation was also conducted as became familiar to the teacher environment and could easily conduct interviews and feedack sessions as per the centre's schedule.

Places visited

Verve centre, Mumbai
Learning centre for dyslexics in Mumbai.

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

Children are screened and go through a series of neuro-assessment test. Clinic assigns LD certificates to receive education provisions for dylsexics in schools.

MDA

Maharashtra Dyslexia Association is a not-for-profit organisation and an initiative by parents and educators committed to securing the rights of students with Dyslexia. It was established in 1996 and since then provides diagnostic and remedial services.

Among these, verve centre was visiting multiple times during the course of the project for interviews, participant sessions, to valdiate concepts , prototypes and for evaluation.

People Interviewed

Ms. Rukshana Sholapurwala
Is the clinical psychologist and special educator that coordinates screening an assessment of children at KEM Hospital.

Ms. Namita
Is a special educator with the Verve Centre and teaches dyslexic children.

Ms.Masarrat Khan
Chief Executive Officer, Clinical Psychologist, Counsellor, Dyslexia Therapist at MDA.

Ms. Akanshi
Children Psychologist at verve center. She also overlooks screening and designs the lessons.

Mrs. Sheetal
Special educator at verve teaches maths and English and also help children with school work.

Top : KEM hospital

Middle : Remediale education at verve centre, image source : ww.veenabasu.com

Bottom : MDA logo

Educators	Interviewed	Observed
Pre K - 2nd grade	4	3
3rd grade	1	2

Children	Interviewed	Observed
Pre K - 2nd grade	5	5
3rd grade	0	1

Psychologist/Therapist	Interviewed	Observed
Clinical	2	2
Children	1	1

* Many Phone interviews were conducted for feedback as I was in constant touch with the educator at Verve Center

Along with the above numbers random informal phone interviews, social media talks were also conducted to get better context. Parents were approached but I didn't get chance to meet and talk to them perhaps the stigma is relevant. My project scope also focuses on the dynamics between educator and child still I researched extesively on parents behavior and effect of home environment on children.

User Study Stages

User studies were spread across multiple stages during the project duration. **First stage started with discussion of documented** traits of dyslexic children with educators and psychologists and getting to know their perspective based on years of experience.

Second stage focused on discussion on ideas and teaching methods that are existing. Phone interviews and visit to Verve centre were frequent during this stage. Feedbacks were noted and incorporated in design.

Third stage included User Testing of working prototype and observing children behaviour. Evaluation plan was executed and feedback were noted.

The research site for the better chunk was at a learning centre. The reason being I got to know the progress of children and got to know their personalities and way of learning. For data collection MDA and KEM were chosen. It helped in gathering information about how children who do not have special education access get help.

The data collected was a mix of both qualitative and quantitative. Main approach was observation, interviews, documentation via photo, audio and video and collecting artefacts. I spend time with educators and children through their sessions as they move from one class to another and one exercise to another.

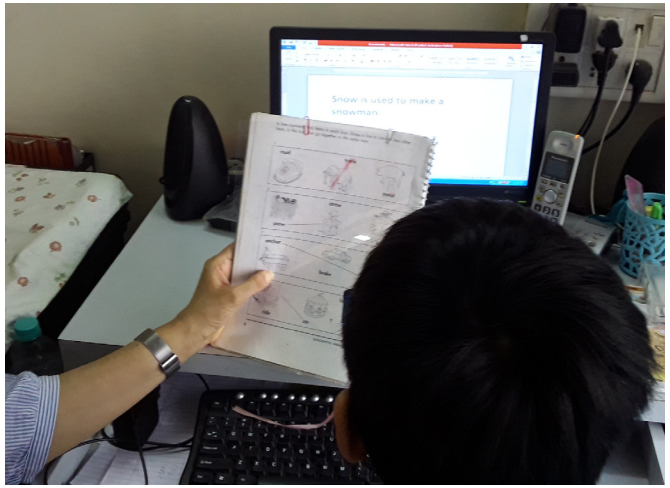
Observation protocol

Time was spent at a single table at a time as the sessions were often one to one between educator and teacher. Teacher's behaviour was recorded as how she conveyed concepts and applied different techniques to teach English.

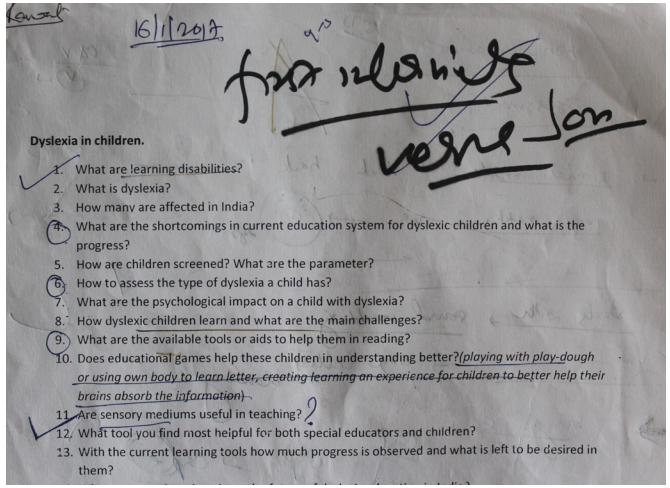
For session observation I acted as a **silent observer** and took notes on how long it took the child to respond to a teacher question and form a response. Child handwriting, snippets from dairy, assessment reports, drawings, board games etc., were recorded.

Interview protocol

For first stage I created a structured questionnaire as I had came up with many questions based on my initial study.



Ms. Namita special educator at VERVE helping 7 year old boy to understand relationship and type in MS WORD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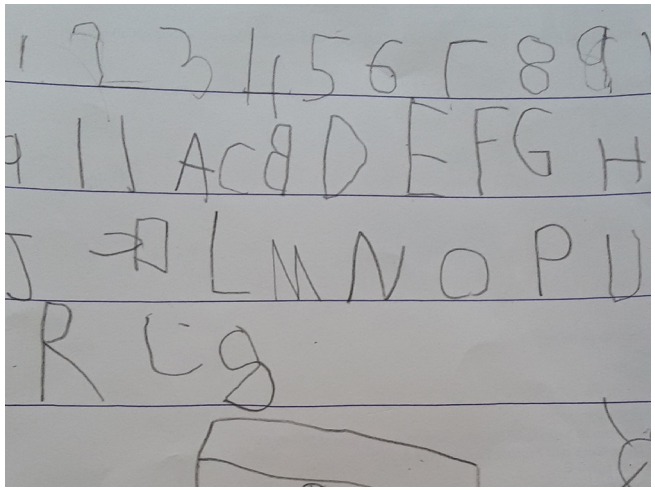
Dyslexia in children.

1. What are learning disabilities?
2. What is dyslexia?
3. How many are affected in India?
4. What are the shortcomings in current education system for dyslexic children and what is the progress?
5. How are children screened? What are the parameter?
6. How to assess the type of dyslexia a child has?
7. What are the psychological impact on a child with dyslexia?
8. How dyslexic children learn and what are the main challenges?
9. What are the available tools or aids to help them in reading?
10. Does educational games help these children in understanding better? *(playing with play-dough or using own body to learn letter, ~~creating learning an experience for children to better help their brains absorb the information~~)*
11. Are sensory mediums useful in teaching?
12. What tool you find most helpful for both special educators and children?
13. With the current learning tools how much progress is observed and what is left to be desired in them?

Early drafts of questionnaires I used for intervews and discussion.



Handwriting of dyslexic children who has started learning alphabets but is very behind his peers at school

Toys at the centre. These are crucial for children with ADHD and it often overlaps with Dyslexia

The extensive stages of user studies were very benefitial as I could make, test and refine many times to strengthen my concept. Here we can see my first paper prototype. I marked them with post-its and distributed among children to observe behavior and in the end took feedback and questions.

The questions were designed to learn about the teaching of the various components of reading and language instruction. Open-ended questions that allowed teachers and therapists to elaborate on the technique and clarify the process of instruction were used. All response was audio recorded along with photos. Consent was taken before any kind of documentation. **Photos of children were not taken except during an activity.**

The interviews were often left open as sometimes the discussion went in different directions that provided unexpected insights. I will discuss this one in the content analysis at KEM hospital section.

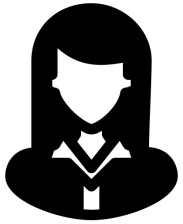
Data analysis protocol

The analysis involved searching for patterns that would guide the hypothesis forward. Affinity mapping was conducted to form design strategy and consderations for ideation and conceptualisation.

MDA

At Maharashtra Dyslexia association, I Interviewed **CEO Mrs. Khan(Chief Executive Officer, Clinical Psychologist, Counsellor, Dyslexia Therapist, Certified Academic Language Therapist)** about their objective, dyslexia myths and ongoing research. An M.A. in Clinical Psychology & M.A. in English Literature from Bombay University, and a Certificate in Dyslexia Therapy from the Multisensory Language Training Institute of New Mexico, Ms. Khan has an experience of more than 24 years in the area of Learning Disabilities. She heads MDA and has steered its growth and expansion over the years. She has been responsible for developing MDA's unique internship programme and is the Course Coordinator, Trainer and Clinical Supervisor.

With her vast knowledge she helped me understand the importance of early intervention and its challenges. **It was revealed that remedial education is a long process and in general at MDA it takes four days per week classes for at least two years to bring the child up to his grade level reading fluency**. MDA conducts training and workshops for teachers and is also in



Masarrat Khan – Chief Executive Officer, MDA

Interview focus : Dyslexia myths, ongoing research, assessment tools, teaching methods an challenges.

Key observations :

1. There is no visual element in dyslexia, 'b' and 'd' reversal is not specific to dyslexia.

2. Early intervention and positive feedback is crucial

3. Sight words need to be taught to dyslexics as they can help make sentences.

Orton method is structed step by step structured process to introduce reading skills in dyslexics. Image source : Dr. Susan Nolan frm Ohio Uni. teaches using orton method.

collaboration with Institutions in creating assessment tools. She stressed on to know about use of Orton Gillingham method which is a structured teaching method to teach children struggling with reading disabilities in a class environment.

However the assessment should be careful as children can be late bloomers or have low intelligence but as the maximum brain development takes before 4 years, its very crucial to start giving help at the earliest.

She stated schools are much difficult for dyslexics rather than higher education as “in schools all the medium is English, stress is on reading and writing in English language, in college there is no stress on language, you know your points, you get your marks.”

In the subject of sights words she stated these are the words which are most frequently used words in english langauage and are the first ones that child learns. But dyslexics have issues in even spelling these out. Like ‘and‘, the, etc. They should be introduced in phases to children. Kids need to learn them by memory and associate to create sentences.

MDA interview - Observations

1. Student cultivate coping mechanisms to avoid reading and any confrontation. e.g. guessing word based on context.

2. Teachers in India at large are not trained to assist a child who has learning disability.

3. As maximum brain development takes before 4 years of age, its very crucial to start giving help.

4. Schools are the biggest hurdle for dyslexics. In comparison, college is cake walk. As in major schools the medium of instruction is also in English as stress is on English language to help in better education and career prospects, in college there is no stress on language, if you know your points, you get your marks.

5. Dyslexics do contextual reading. They try to see 2,3 words they can identify-take help of images and rely on attention to verbal cues.

6. Homonyms are harder for dyslexics to understand due to similar sounds. to/two/too etc.

7. There is no visual component involved in Dyslexia, its totally phonological disorder.

Design implications

1. Follow a structured approach in learning instructions.

1. Tasks to build skills around child's strengths to reinforce confidence.

3. Method to reduce time taken to bring child to grade level reading level.

4. Focus on primary learning grades as they are the right time to approach dyslexic remedial education.

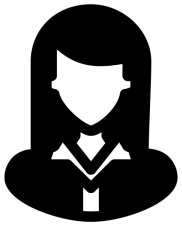
6. Motivate children even for trying and reward them positive feedback.

7. Put feedback mechanism.

8. Self paced is learning is good to have in such scenarios.

phonological disorder.

No visual reversal



Rukhshana Sholapurwala - Clinical psychologist and special educator

Interview focus : Why certifications? Main learning issues, assessments in other Indian languages.

Key observations :

1. Symptoms like difficulty in school learning, often clumsy, hyperactive, Language problems, immature speech, reverses letters or places them in incorrect sequences Example: 'd' for 'b' and 'saw' for 'was.

These above symptoms can be found in all children at some time during their development, however a child with learning disability has a cluster of these symptoms which do not disappear with advancement of age and needs further examination.

KEM - King Edward Memorial Hospital, Learning Disability Clinic

The interview at KEM helped me in getting insights on what area to focus for the aiding in learning as the clinic screens children based on some guidelines of difficulty levels in reading and other issues. It establishes which area the child needs focus and help in.

Learning Disability clinic at KEM hospital Mumbai provides leaning disability certificates. The certificate allows such students who fail 20 grace marks in one or more subjects. They need to study only two languages instead of three. If they make spelling errors or reverse numerals it should be overlooked during evaluation.

Here Children are screened and go through a series of neuro-assessment tests. Clinic assigns LD certificates to receive education provisions for dyslexics in schools.

KEM - Observations

“Schools promote child up to grade 8 and the child never gets attention or special focus on learning and reading to be specific. After 8th when the curriculum becomes more tough, parents panic and so do the teachers.“ She added.

In such scenarios children who are learning disabled are also promoted along with the other students and thus the problem is never addressed. Learning Disability clinic at KEM provide certificates from 9th class onwards as most school refer children from this grade onwards as it affects the school’s result. Its not just about policies but also about how early the child can be assessed and remedial education can start in the required field.

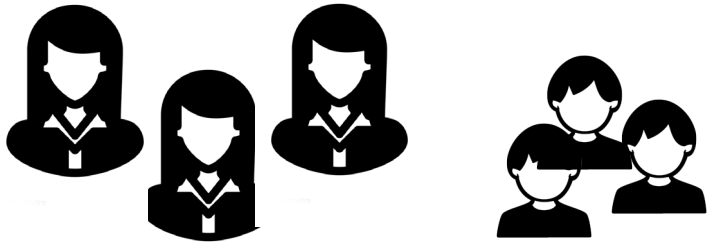
She also mentioned about the research at NBRC(National Brain Research Centre) at Maneser and how she was the part of team that researched for a tool for assessment of learning disabilities in Indian Languages. However she states that English is crucial to be taught to all in inclusion as it is what makes it has become the medium of all relevant social interactions and it paves a way to academic independence and better education choices when the student leaves school. Though English is a second language to us, it binds the country and the world together.

She stated how its mandatory to promote reading disabled children up to 8th standard as stated by government.

Assessments are only done from class 8th onwards. There is a two month long period to completely grant certificate for extra time in classes and option to drop subjects.

She stated that early intervention is crucial from age 3 onwards as child starts to speak and any issues can be recognized from either parents or play class teacher like late speech etc.

The interview at KEM helped me in getting insights on what area to focus for the aiding in learning as the clinic screens children based on some guidelines of difficulty levels in reading and other issues. The interview helped in taking the research further and making scope more specific as I gathered more content to set up my context.



Ms. Namita - Special Educator
Ms. Veena Basu - Special Educator
Ms. Aakansha - Clinical Psychologist

Interview focus : Teaching methods, remedial education environment, dyslexia with ADHD. Existing instructions in action.

Key observations :

1. Flexible lessons. No pressure on children to follow a lesson plan. However daily sessions are planned.

2. lots of material were used in addition to direct instructions.

3. Dyslexia and ADHD often overlaps. Engaging child in learning is a challenge for both educators and parents.

4. Children learn phonics to understand alphabet rules.

Verve centre

Veena Basu, the founder of verve centre has Masters in Special Education - Learning Disabilities and more than 25 years of experience to maintain effective learning environment for children with special learning needs. She also has the strong commitment to see her students learn and achieve the most during their most important learning years.

I chose verve centre as the setting for my detailed interviews and observatoin sessions with children as the environment is very welcoming and there is a sense of play and learn both in though and practice.

Verve centre follows individual sessions for children for minimum one hour daily. For children with more needs such as with ADHD even spend three hours daily after school. The centre follow a c2c curriculum, ‘chaos to clarity’ that based on foundation phonic instructions accompanied by cognitive skills training or ‘neuroplasticity‘ which states that our brain can be rewired based on external stimulus.

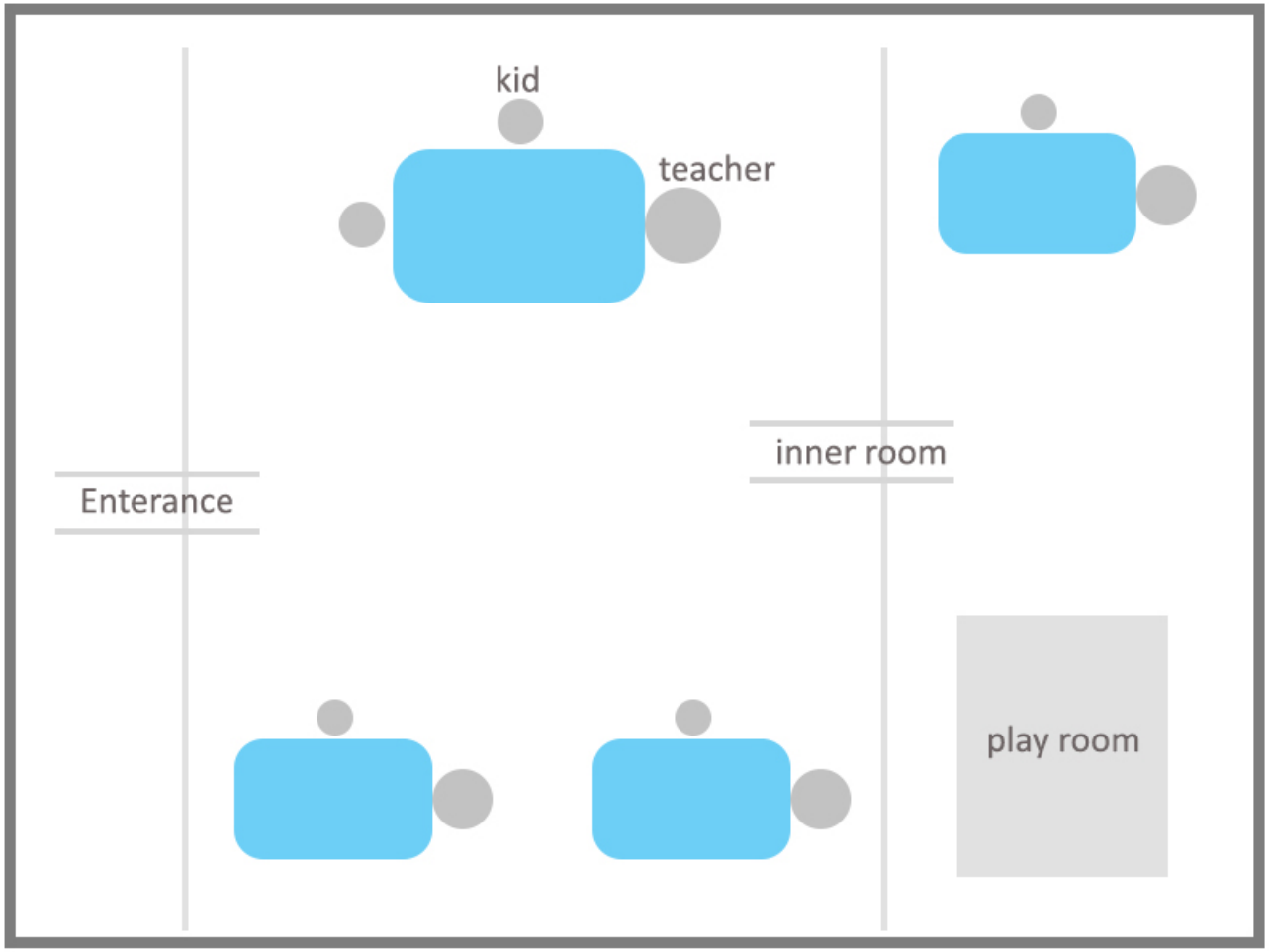
There are two centres and each day children

Attend after school for on average one hour sessions. The sessions are very flexible and are focused on exchange of dialogues between the educator and the child. The teacher plays and performs activities with the child. Each desk sits one or two children and one educator at a time. There are games to engage children in a learn and play environment. There are no forced lessons and child learn at his own pace and the assessment of child's progess also keeps up with individual pace.

It was a different experience from regular teacher-student learning scenario as each table is separated from each other so full attention can be directed towards a child so the child has better scope of getting required attention.

Ms. Namita is special educator here, she iterated many times that sooner the child comes under radar the better. She explained with examples of children coming in as late as in grade 5 and not even knowing how to spell simple (CVC words) consonant-vowel-consonants.

She explained how parents become hopeless and how the environment at home affects the child under such circumstances. She insists to teach phonics first and slowly step by step increase the child's vocabulary.



Sitting arrangement at the centre

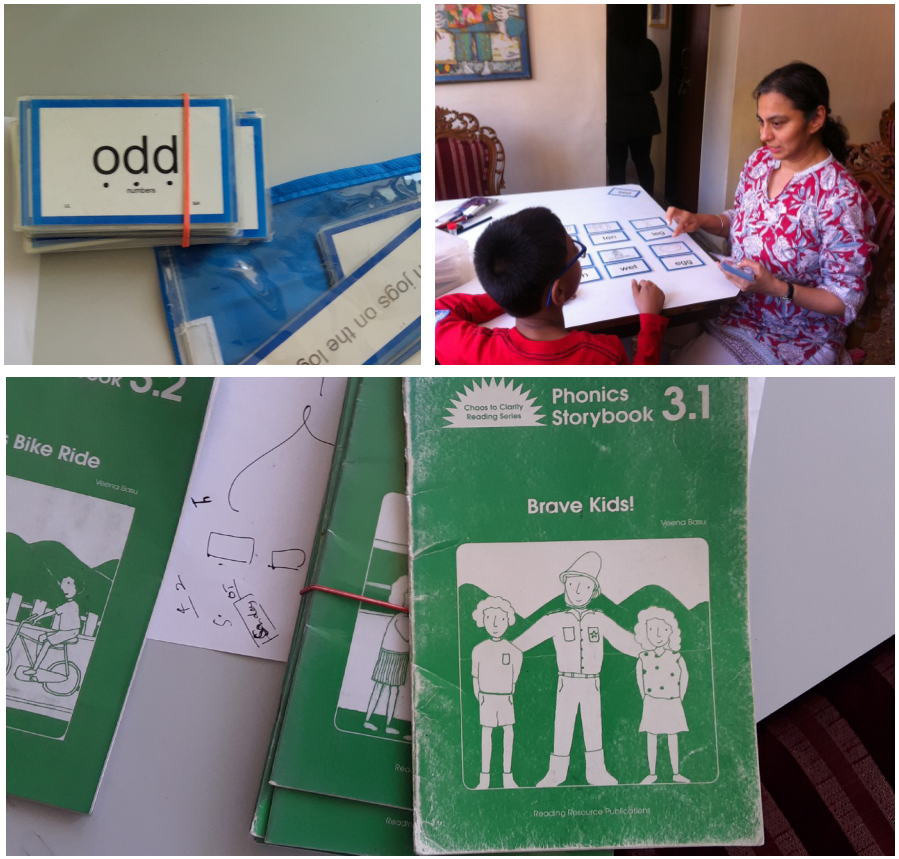
Teaching method

Special educators at verve follow the phonic method of teaching as it helps children the most during the learning process. Through phonic storybooks letters are introduced in a story driven step by step manner. There is a series of books and each book explores the one particular phoneme. The phonemes progress to more complex diagraphs at the higher level book which further lead to sentences and then story reading.

My approach for user studies at Verve

I approached verve during all stages of my user study as mentioned in *section 5.2. I conducted interviews, participated in sessions, interacted with children and played games with them.* **My goal was to observe child behavior and learning patterns**.

I frequented the centre and held discussions in perosn, over phone and conducted early and final testing of my prototype.



Artefacts : Learning content at verve
top left : Flash card used in teaching blending with /o/ sounds with images.
top right : Educator in an ongoing session: image source : Verve.com/gallery
Bottom: Each book explores one phoneme but its hard for children to sit down and make them read.

My first was to understand the context to build the foundation of my design intervention.

1. Understanding context of dyslexic education

As I mentioned my primary aim of spending time with children and educator at the centre was to understand the child routine, behaviour, motivation, pain points and needs. I prepared agenda for each session and noted down important points during the session and then interacted with the educator. I participated in games, one to one sessions.

Attempt was also made to understand parents context as well. Much was cleared about the same by Ms. Namita. She mentioned parents who are financially sound can put their children in private schools where teacher child ratio is low thus the child can be identified earlier, but same is not true for lower middle class people. However they still help such parents.

Educator's perspective was understood very clearly during long interviews and discussions. As I engaged with many educators across various organisations I could really piece together a pattern that could be a strong concept to be explored.

My first was to understand the context to build the foundation of my design intervention.

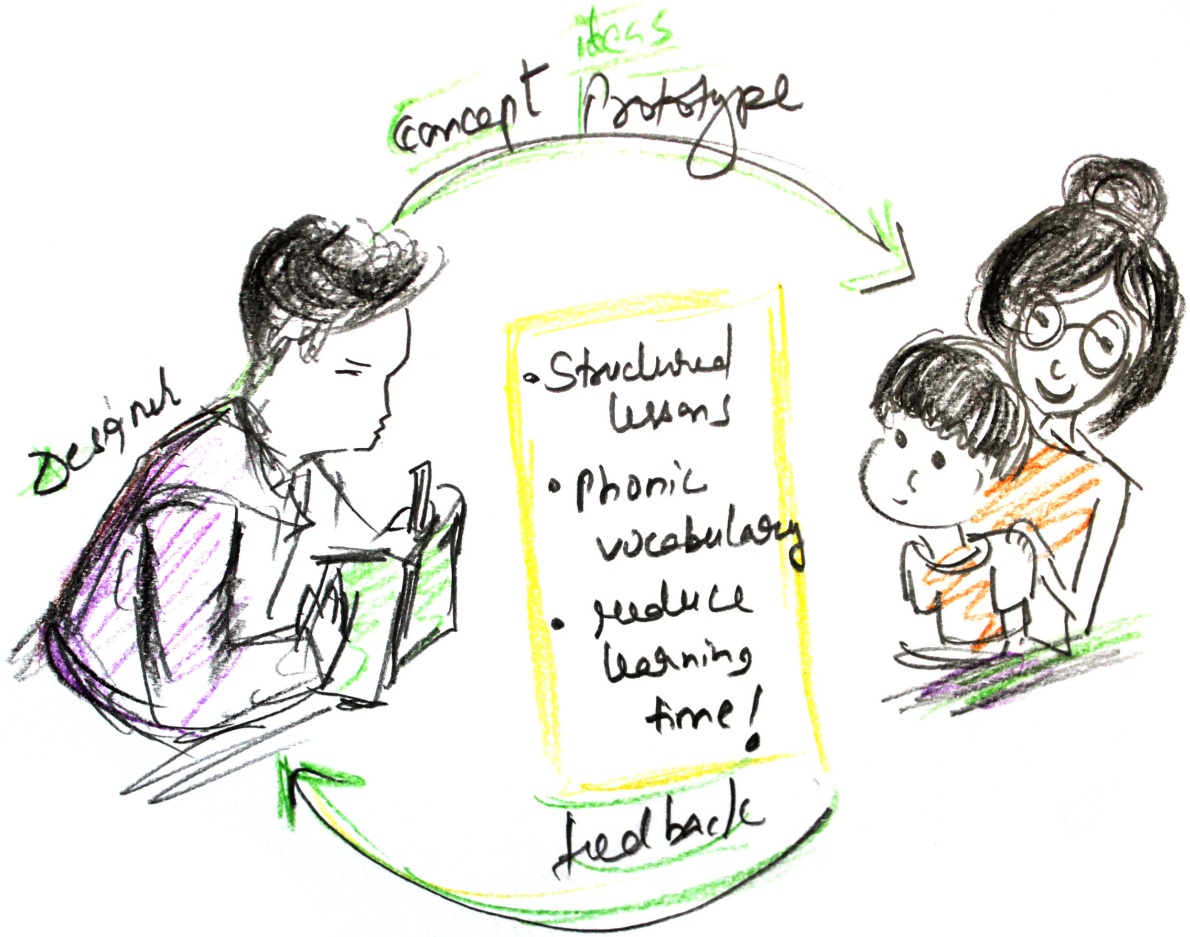
2. Participant, observer, documenting

I often asked question during the early sessions and sometimes just observed taking down notes. The technique helped a lot in empathising with the target user and understanding their mental models and behaviour.

Audio and video documentation was conducted to later piece the session together and note down if anything was missed.

3. Prototyping , testing and feedback sessions

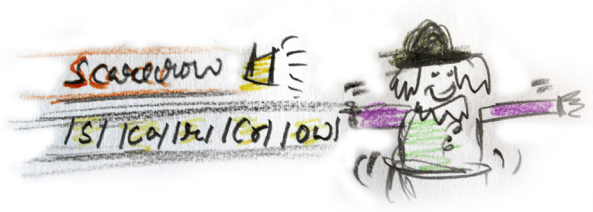
As the user study spanned across stages and throughout the design process. I created task around their daily learning to test my ideas. I also spent time testing early concepts converted via rapid prototyping into low fidelity interactive tasks and collected feedback to refine them further.


ideas
Concept
Prototype
Designer
• Structured lessons
• Phonic vocabulary
• reduce learning time!
feedback

Verve - Observations

1. From observing children

1. Children are confident verbally and respond well to question based on a story or rhyme. For example educator tells a short scarecrow jingle with hand gestures to sound out the word.



2.Children with dyslexia and accompanying disorder such as ADHD were confidant in speech but had very had very less concentration and engagement with the learning material.

3. The teachers often use visual cues with hands and movement and explored a task together with the kids.

4. Children learn on cues, for writing they need support dots in a line, to read a paragraph they require a scale to track the letter positon.

5. Child has a special bond with teacher and responds to her memory triggers or other audio or visual cues.

6. As I introduced some games on tablet to the children they were very eager, however I didnt see any digital aid apart from typing being used to enhance the learning.

7. They are visual thinkers and they describe each step as they go step by step into an exercise.

8. Instruction happens one on one. The child gets educator's full attention and next lesson or activity is not started until they are sure the child has grasped the concept.

9. They are poor speller which contributes to poor handriting. Coupled with dyscalculia they have a hard time writing and need occupational theray addiontionaly.

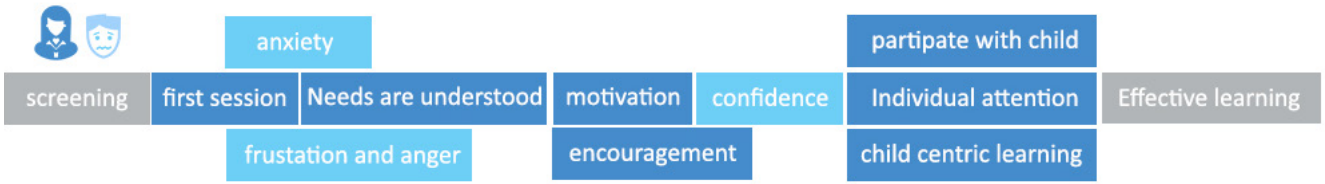
10. Different children respond to instructions differently. Dyslexia is a spectrum disorder, yet the underslying matters are mostly common.

11. Children leanrn mostly through sound and visual correlation. but engagement is challenging.

2. From observing Educators

1. Educators feel that the weakest link is motivation and encouragement to the child.

2. Educators understand that teacher to child ratio matters a lot in identifying children with learning disability early at young age.



Touch points during remedial education

3. Acting out the lessons with the children makes them engaged and helps in bringing concentration. Keeping them excited about the outcome.

4. Teacher guides the children through daily session from exercise to exercise. However small breaks are taken in between for an activity as the children have poor concentration.

5. If the instruction method of dyslexic teaching involves audio as well as visual stimulus, as in a video/film or a guide or person/educator narrating out things in a book/application (guide narrates : audio, book/application: visual), This would increase the ways and the chances of the child actually grasping the content clearly . Since ADHD overlaps often with dyslexia, if the instruction method uses multiple senses and modalities , thus engaging more than one senses, this increases the time the child is paying attention and consuming the content while building memory.

6. MDA centre uses a different method for remedial education which is also scientific structured method like PHONIC method. But still the underline theme is introduction to letter sounds .

7. The teacher helps the child explore a single sound at a time with different examples.

8. Define clearly to the child, what exercise we are doing, why we are doing, with examples based on audio and visual cues. Focusing on content would yield better results.

9. Child shouldn't feel pressured to do a task or exercise.

10. The contrast between what is being read and the background should be clear.

11. Don't mix children. After some time is it ok to let two children learn together but individual attention is must.

Design implications from observing children

1. Design has to be interactive and a dialogue.

2. Target intervention after the assessment is completed. Criteria will be based child's current learning capacity.

3. Motivation should be in-build in the system.

4. Proper visual and audio cues to drive child forward into reading.

5. Maintain a visual sound vocabulary/dairy/ notebook so the child can revise and practice in return of a reward.

6. Design to engage in content and not the process.

Design implications from observing educators

1. After some time give children something different that relates to the exercise in some way. This would remove monotony and engage child longer

2. me time give children something different that relates to the exercise in some way. This would remove monotony and engage child longer

3. Instruction should not directly mimic the instructions but pave a way to faster practice and revision.

4. Design should invite the child and have goal for each day that promises individual growth in a fun yet productive way.

Intervention opportunities

Current reading instruction need interactive aspect for active involvement with learning. Multisensorial approach can be explored but the feasibility will have to addressed as children in such scenarios develop emotional and psychological distress.

As the learning scenario is work on constant positive feedback and encouragement, elements of gamification can be utilised with companion guides and tasks for more enriching experience. This not only trumps the regular way of bridging phonemic awareness but also strengthens skills of dyslexics to decode heard and seen language patterns and structuring them into sentences.

Focusing on Phonetic awareness very early in scholastic life will make dyslexics well equipped with essential tools to make way through academics and excel in their fields of choice.

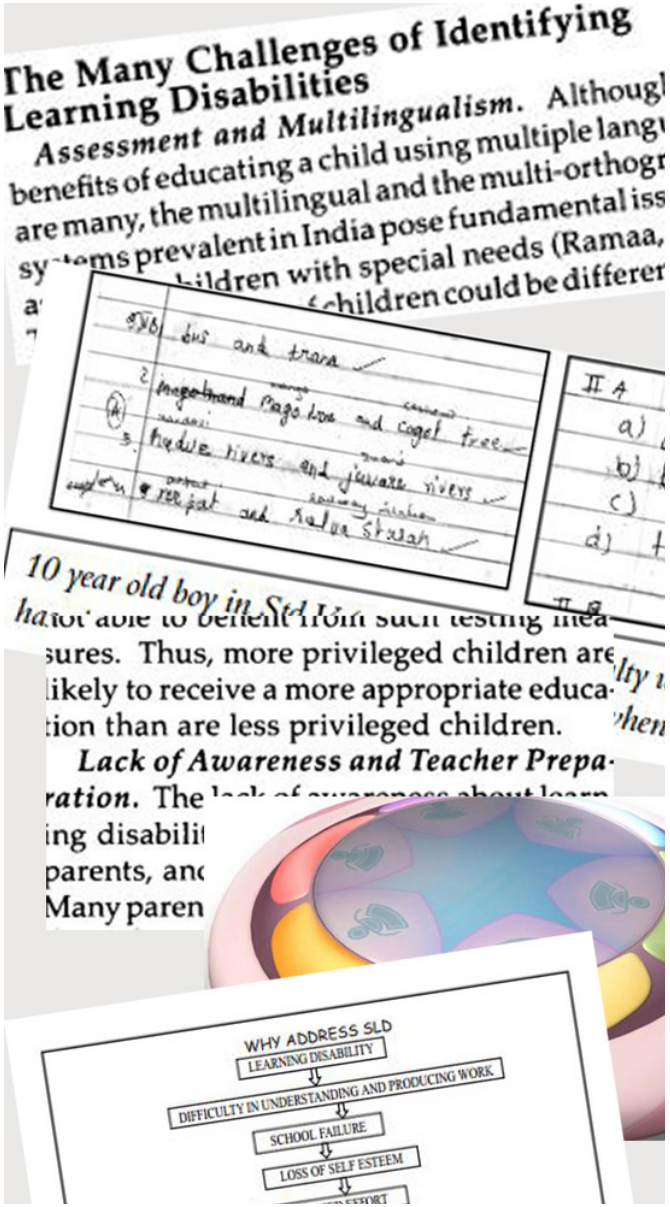
Widespread hand-held devices across households and children's exposure can be utilised in impart a solution.

The issues with reading, spelling would becomes smaller issues with intervention through technology and supported software or aids. Such applications can improve child's reading.

As more and more technology is getting intoe education and virtual classes are coming into picture, the area of learning disability can leverage this and help building confidence in child as hey/she can read and learn anywhere anytime , allowing them to concentrate on the content.

It can provide the necessary risk taking, patient, multi-sensory environment many dyslexic learners need. This can result in increased confidence and self esteem, enabling users to see, hear info, repeat and review, try out and make as many as mistakes etc.

Teachers can also identify child's progress. Such intervention will promote learning for the child in an independent way.



Secondary Research

This section contains my initial study on learning disabilty leading on to dyslexia and literature review.

Learning disability

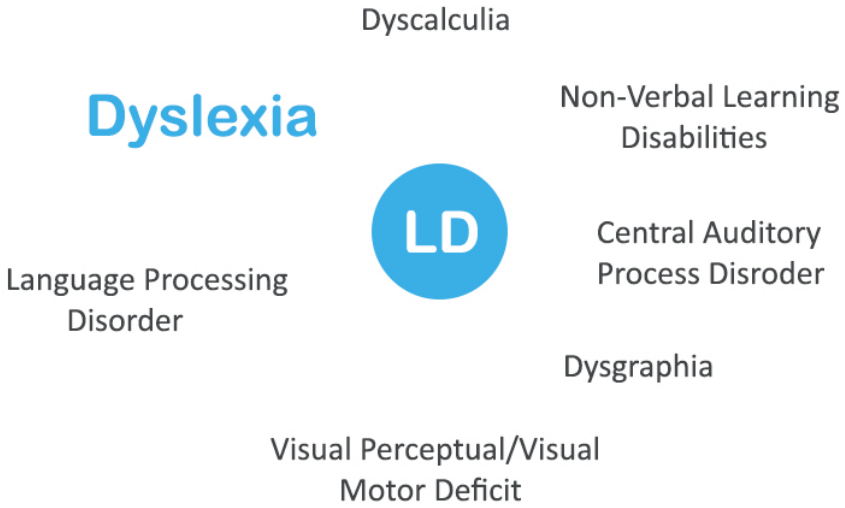
The research initiated with going through available literature and research papers with an aim to locate the problems in learning alphabet and words. Going further, I looked into people and organisations and researches involved into solving the problem with dyslexia in India and the world. As I was doing background study, I wanted to see and observe the teaching methods I learnt about and traits and behavior of dyslexics in the real world, therefore I narrowed down on people and institutions to visit and conduct interviews. Thus data collection started parallely with visits to learning disability centre and interaction with children and educators and therapists.

To understand dyslexia one need to understand learning disability first. Learning Disability is the umbrella term which consists of learning issues arising from neurological differences in brain structure and function that affects a person's ability to receive, store, process, retrieve or communicate information.

These inter-fare with a persons learning skills with respect to reading, writing and mathematics. These are best described as unexpected struggle in schools and difficulty in reading or any other learning behaviour.

Learning disability results from a difference in the way a person's brain is "wired." Children with learning disabilities are as smart or even smarter than their peers. But they may have difficulty reading, writing, spelling, reasoning, recalling and/or organizing information if left to figure things out by themselves or if taught in conventional ways. There is more about difference in learning ways rather than absence of intelligence.

A kid is normally diagnosed with LD when in early schooling whch leads to opting a special education process. There is no cure and these conditions are life long but through special training and targeted learning techniques they can be challenged in a positive way.



Types of learning disabilties.
Dyslexia is the most common of all.

Classification of Learning Disability

Auditory Processing disorder
Children with this disorder aren't be able to articulate different sounds. They won't be able to recognize subtle sound differences in a word. a simple calculation. They might be intelligent in othe raspects, yet they have problems with number and calculations.

Dyslexia
Reading Based and most common. Severity can differ in each individual but can affect reading fluency, difficulties with word decoding, rate of reading,rhyming, spelling, vocabulary, comprehension and written expression. It is the most prevalent and well-recognized of the subtypes of specific learning disabilities.

Dysgraphia
Affects a person's handwriting ability and fine motor skills. Child does not have the complex set of motor and information processing skills that are required for writing. Difficulty in writing as well as thinking and writing at the same time.

Dyscalculia
A specific learning disability that affects a person's ability to understand numbers and learn math facts. The child would have difficulty i understanding basic math concepts. Remembering or recalling number sequences is also an issue.

Visual Perceptual/Visual Motor Deficit
A disorder that affects the understanding of information that a person sees, or the ability to draw or copy. Afftect perosn struggles with holding pencil too tightly and often has poor hand eye coordination.

Language Processing Disorder
Affects processing of language. This is a specific type of Auditory Processing Disorder (APD) in which there is difficulty in attaching meaning to sounds, sound groups that form words, sentences and comprehension.

Non-Verbal Learning Disabilties
Children have trouble interpreting nonverbal cues like facial expressions or body language, and may have poor coordination.

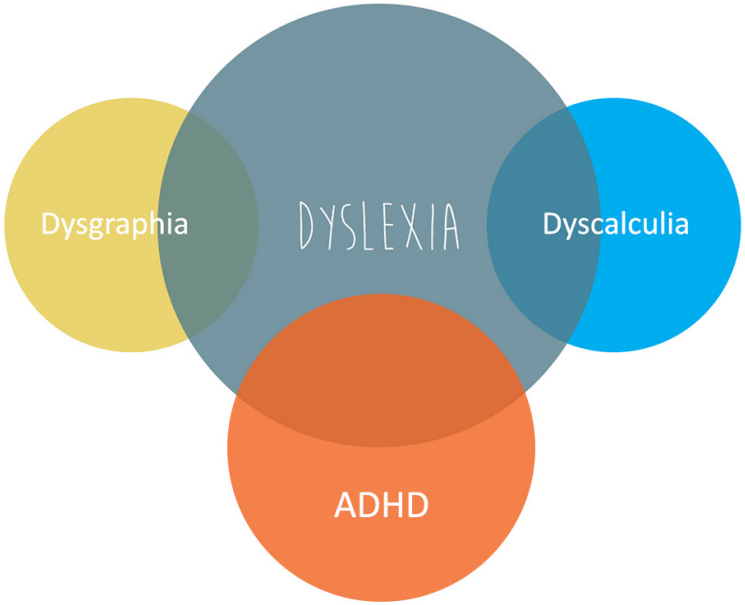
Other related disorder are :
Attention Deficit and Hyperactivity Disorder(ADHD) - difficulty staying focused and paying attention and controlling behaviour.
Dyspraxia - problem with movement and coordination.

Relationship between Dyslexia and other disorders

As Dyslexia is the most common of specific learning disability, it often overlaps with Dyscalculia and Dysgraphia. Dyscalculia is somtimes called math dyslexia that causes problems for kids when it comes to reading, writing and understanding numbers.

Also just like Dysgraphia affects children's ability to spell and write correctly, Dyslexia affects spellng and writing but in less specific way as Dysgraphia also causes issues with motor abilities like holding a pen and better grip etc.

Also one third to a half of all the children with ADHD have co- occuring issues like Dyslexia. Also, 15-3% of those with dyslexia have coexisting AD/HD(Attention-Deficit/ Hyperactivity Disorder). Coexisting means the two conditions, AD/HD and dyslexia,can occur together, but they do not cause each other[4]. This fact was observed in real life during user studies the next sections.



Dyslexia is often seen as inclusice of one more kind of disorders

Study of research papers, articles

Through decades significant advances have occurred in dyslexia research. This has aided in the explanations for dyslexia and creating policies and practices. Investigators from different disciplines such as, education, psychology, paediatrics, speech and hearing and even psychiatry have been involved in active research.

In the paper **Educational Provisions and Learning Disability**[5] it is stated there has been a much positive impact due to the education provision in India in the last decade in the regard of learning disabilties. It gives certain statistics that **dyslexia (or specific reading disability) affects 80% of all those identified as learning-disabled**.The incidence of dyslexia in school children in USA ranges between 5.3- 11.8%. The incidence of dyslexia in primary school children in India has been reported to be 2-18%, of dysgraphia 14%, and of dyscalculia 5.5%.

The paper elaborates the efforts and eduational provisions set in place by Maharashtra government to tackle special learning disabilties, which are refereed as SpLDs. Children who have been assessed by government regulated bodies of any specific learning disability The paper explains in details the situation with Learning disability in India and the challenges faced by schools, government and organisational efforts. It talks in length about MDA (Maharashtra Dyslexia Association) which was part of the technical team behind Bollywood movie on Dyslexia, Taare Zameen Per, about how it started and its impact

Since 1996, the state government of Maharashtra has granted children with LD the option of availing provisions at Senior Secondary Certificate (SSC)examinations. These are 1)extra time of 30 minutes for all written tests with spelling mistakes being overlooked, 2) employing a writer for children with dysgraphia, 3) exemption of a second language (Hindi or Marathi in an English medium school) and substituting it with a work experience subject, 4) exemption of standard ten mathematics (algebra and geometry) and substituting it with a lower grade of mathematics, mainly standard seven.

The state government issued a circular in 1996 to all school principals to make these provisions available to students with learning challenges studying in standard I to XII.

Most notable are the exemption of a second language (Hindi or Marathi in an English medium school) with any word experience subject etc. Such provision result in children being promoted till secondary grade after which assessments certification can be taken at government authorised centres such as KEM (KING EDWARD MEMORIAL HOSPITAL). KEM has an LD clinic that issues LD certifications to children from grade 8 onwards.

In some contrast to these provisions, Dr Brinda Jayaraman and Vidya Thirumurthy in the paper Special Education in India[6], state that **though there have been government and organisation efforts but still the root of the issue needs more attention, to illuminate the rough road ahead for special needs children in inclusivesettings.** Even though the government policy takes a stand, individuals have to hold the government responsible for implementation. It It suggests that changes will occur only when parents demand appropriate environment and education for their children and such a change needs to happen at the grassroots level, in villages and rural areas where parents are usually unaware of the services available for their children and thus need to be informed. The paper critiques on Indian Education system and the challenges in identifying learning disability in India.

Difficult assessment

The main issues with identifying Dyslexia or any other Learning disability in India are the assessment and multilingualism challenges. Most of the Indian children are bilingual, for e.g. a child who speaks Tamil, a Dravidian language, at home may live in a northern state where Hindi is widely spoken and may attend a school where the medium of instruction is English. This exposure to three languages is very demanding for an average Indian student and coupled with learning disability the simple task of reading becomes a mammoth one.

Failed inclusion

Strong comments are made on the ‘inclusion‘ policy of schools. Although some schools are inclusive, acceptance is based on school’s capability to provide services. When I raised this topic during interviews from the paper It was revealed that some schools even fail the struggling children so that the all round result of the class in not affected.

Social Stigma and awareness

The lack of awareness about learning disabilities. among general public has given rise to social stigma. Also, lack of parent awareness further prevents parents from talking about this to the teacher and identify chid’s special needs.

This situation is different in case of financially strong middle class families as they are somewhat aware of any lack in child’s progress in schoold and also the schools these children attend have established some parameters to identify such children and inform the parents.

The paper concludes with the outline of more resource centres of chidren across the country and a network of government clinics to reach out to wider children and parents. It also suggests the desire of a well needed assessment tool in vernacualr languages.

Dyslexia in biliterate children

Before moving on to the inerviews I wanted to read more about learning disability problems in Indian langugaes as even when english is much more important from a higher education point of view, our national langugages still have millions of speakers who read and write in them.

S. Cherodath and N.C. Singh in their paper on influence of orthographic depth on reading networks in simultaneous biliterate children [7], state that dyslexia in different langauages is affected by the relationship between the speech sounds(phonemes) and letters (graphemes), also called orthographic transparency. languages that have a one-to-one relationship between its graphemes and phonemes are called orthographically transparent like hindi, wherease English has more of an opaque orthographic transparency.

Orthographic differences

India has a bilingual society and children in such societies simultaneously acquire reading and writing skills in langauges that vary in consistency of sound–letter mapping or orthographic depth. In this research paper outcomes are described when Hindi- English biliterates were tasted with word and non word stimuli to measure effects.

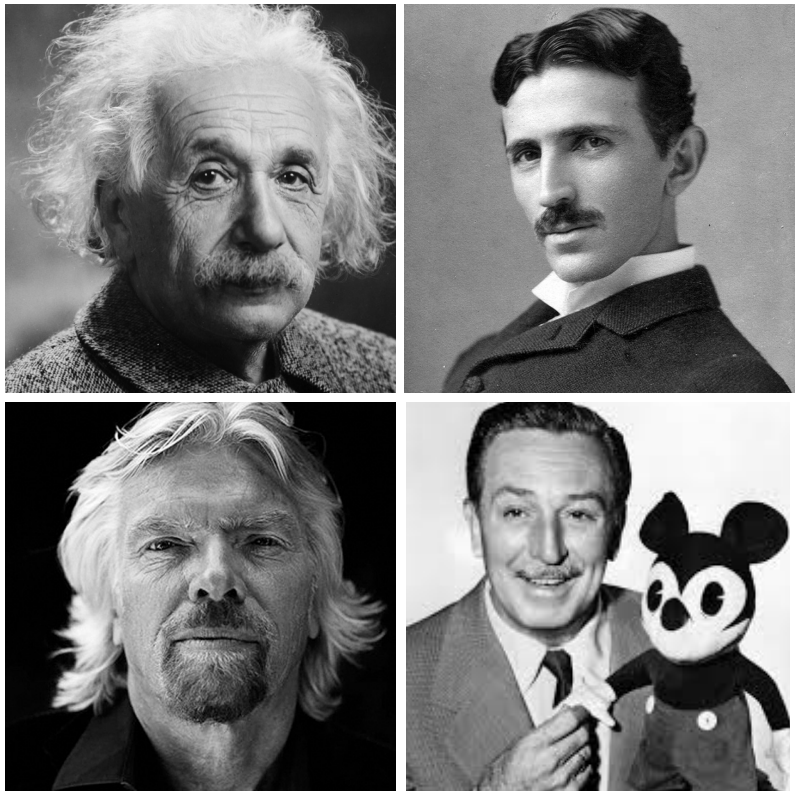
Subsequent analyses showed that the stimulus effect was significant in English, which has a deep orthography, in comparison to Hindi, which is transparent. The results indicted that orthographic depth shapes cortical reading processes during reading development. The crux of the research was that the increased brain activity dyring english non-word stimulus shoes phonological processing load , but not in Hindi. This is interesting as it further proves the inconsistencies in letter to sound mapping in English. Dyslexia in english langauge thus may appear much complex for Indian children as their brains are wired for transparent orthographic consistencies.

In her article Dyslexia and Creativity, Madeline Martin says, *"Dyslexics may not be able to easily decode language, but this weakness is often surrounded by strengths such as reasoning, problem solving, comprehension, concept formation, critical thinking, general knowledge, and vocabulary."* She further adds that it seems dyslexia has more advantages then disadvantages. Though its a life long struggle,dyslexics excel at spatial and visual skills and fields of art, computers and design.

The article mentions that many successful artists, sculptors and entrepreneurs have a history of dyslexia.

English words	English nonwords	Hindi words	Hindi nonwords
Brush	Frush	बहन	बकन
Chair	Chail	नाम	चाम
Bed	Bek	तकिया	गकिया
Home	Bome	कहानी	कहासी
Uncle	Undle	केला	देला

Orthographic studies :word and non-word stimulus testing on biliterates.



Top left :Albert Einstein
Top right: Nicolai Tesla
Botton left : Richard Branson
Botton right : Walt Disney
source: google images

The gift of Dylexia

Dr. Sally Shaywitz from Yale Centre for Dyslexia and creativity says that research supports the ideas that people with dyslexia are more creative. She speculates that they are using the areas of the brain that other people use for reading for their creative endeavors. It is evident that whether by way of “compensation” or simply because of their different neurological makeup, many dyslexic people have exceptional talents in other area

Albert Einstein, Nicolai Tesla, Richard Branson and Walt Disney are Some prominent people who were known to have dyslexia and failed school but when on to achieve great things and reach the pinnacle in their respective fields.

We can take away from this article that that dyslexics learn to persevere. They often get great success later in life as they have to learn to cope during the struggles of their childhood and have been creative in order to learn how to read and study in different ways.

Organisational efforts

Many government and private organisation have been involved in the reseach and intervention work since early 90s. In 1996 In **Mahrashtra Dyslexia Association (MDA)**,a nonprofit service organization was formed by special educators , philanthropists and parents in order to promote awareness and provide training for teachers and children. Since then the organisation has played a key role in spreading awareness in the educational community and the general public, and also in advocating the rights of these students. I visited MDA during the course of the project to undestand their role and ongoing work.

They were also behind the technical team in Bollywood movie 'Taare Zameen per' to help the film crew understand Dyslexia and how to best portray it in order to reach millions of Indians with a positive message.

National Brain Research Centre, Manesar has been involved in some cutting edge research in understanding the neuroscience behind learning disabilities. They worked in the screening tool 'DAALI' for assessment of learning disability in Indian languages. This study was supported by Department for Science and Technology. S. Cherodath with this team at this organisation conducted research on how our brain reacts to sounds and learning in different languages. (The influence of orthographic depth on reading networks in simultaneous bi-literate,2015)

All India Institute of Speech and Hearing(AIISH), Mysuru conducts research and provides services in the field of speech-language pathology and development of assessment materials for Indian languages. They were a part of team in study related to screening tools learning disability in Indian languages.

Apart of these are other organisations such as **DAI, Dyslexia assoiciation of India** that promotes interest, research and develop programs to foster effective learning. Hospitals such as KEM(King Edward Memorial hospital Mumbai) and L.T.M.G. Hospital, Sion, KEM runs a disability clinic to provide certificates to children in order to enable them claim educational provisions.

KEM hospital in Mumbai has a dedicated learning disability clinic.Image source: Wikipedia

NBRC Launched DAALI tool In Oct 2015, to assess Dyslexia in India langauages. image source: nbrc website

Dyslexia

Dyslexia is the most recognizable term in the field of learning disabilities. 1 in 5 people in the world suffer from dyslexia. This puts children in risk of life-long illiteracy and social exclusion. In India, 2-18% of primary children school are dyslexic and about 80% of all identified as learning disabled are affected by Dyslexia(Kulkarni, Karande, Sholapurwala, 2006). 90% of these children can be helped if the diagnosis happens as early in life as possible.Dyslexia as a word is derived from two Greek words: dys (inadequate) and lexicon (word and/or verbal language). Dyslexia therefore stands for problems learning how to read words and deal with language in print.

Dyslexic readers have trouble decoding a word into individual sounds and make sense of it and also to blend sounds to make a word which to an otherwise normal reader is very clearly understadable.

The exact cause of dyslexia is still being researched and there are many theories about contributing factors. It is estimated that Dyslexia can be genetic up to 40% risk of inheritence.

Earlier treatment

Late 19th and Early 20th century

It was then termed as Congenital word blindness ,the defect involved the acquisition and storage in the brain of the visual memories of letters and words. It was believed to be was caused by visual processing deficiencies.

1920s

American neurologist, Dr. Samuel T. Orton proposed specific reading difficulty arose due to dominance of one side of the brain. Teaching strategies he developed during his research are still in use today..

Mid 20th century

In the so called evolution stage (1950-1970), field of dyslexia opened up to a variety of clinical, research, and educational approaches. No longer considered to be under the jurisdiction of medicine. Educational and psychological research began to accumulate at this time, broadening understanding.

Dr. Samuel T.

Identified the syndrome of dyslexia as an educational problem

Problems related to language

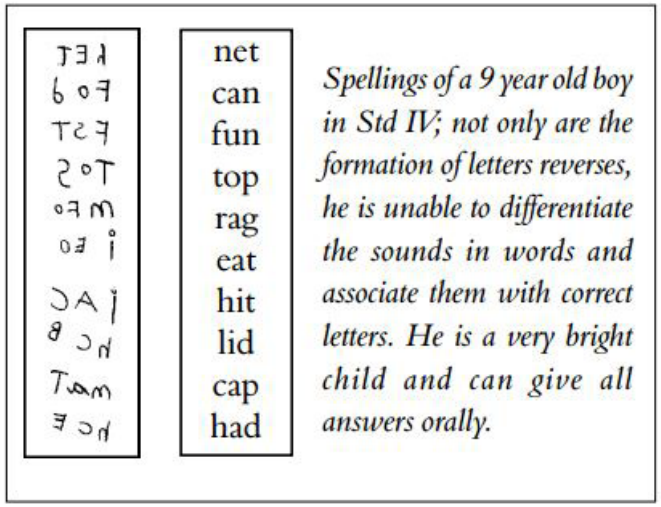
International Dyslexia Association states that problems children face in reading are due to gap in the phonological processing of the brain, which is the ability the detect differences in individual letter sounds. Based on research up to this point, it can be said there are specific language related issues in dyslexia -

Phonic awareness
Manipulating phonemes. Rhyming words such as homophones, homonyms and understanding work meaning.

Letter jumping
Learning word with similar ending or beginning sounds leads to omission of the said part and child cannot read without guessing.

Memorising
Retention and recollection is affected. More the words, lesser is the retention.

Lack in fluency
Struggle in reading sentence together in a coherent manner



Article : Learning disabilities in India
editor : Dr. Marita Adam

Phonological processing gap

The most widely supported theory of how dyslexia affects reading and writing is known as the “phonological processing impairment theory”. To better understand this theory, take example : of the word **Elephant**

Most chidlren can recognize that there are three sound parts in this word

El – e - phant

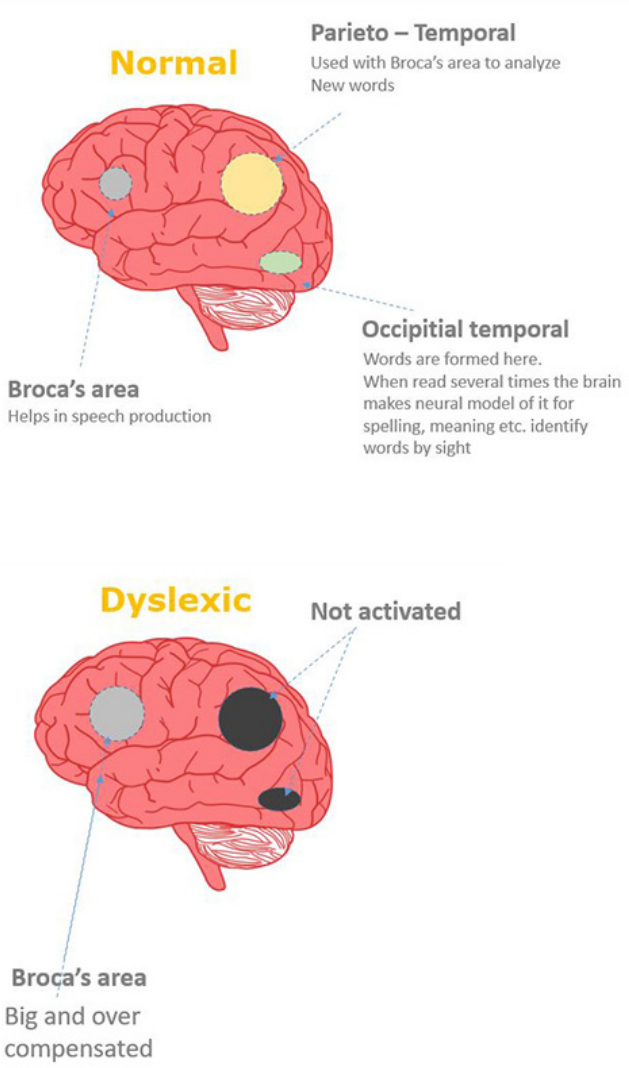
For dyslexics its hard to distinguish that ‘PHANT’ is made up of four different souds

Ph-ae-n-t

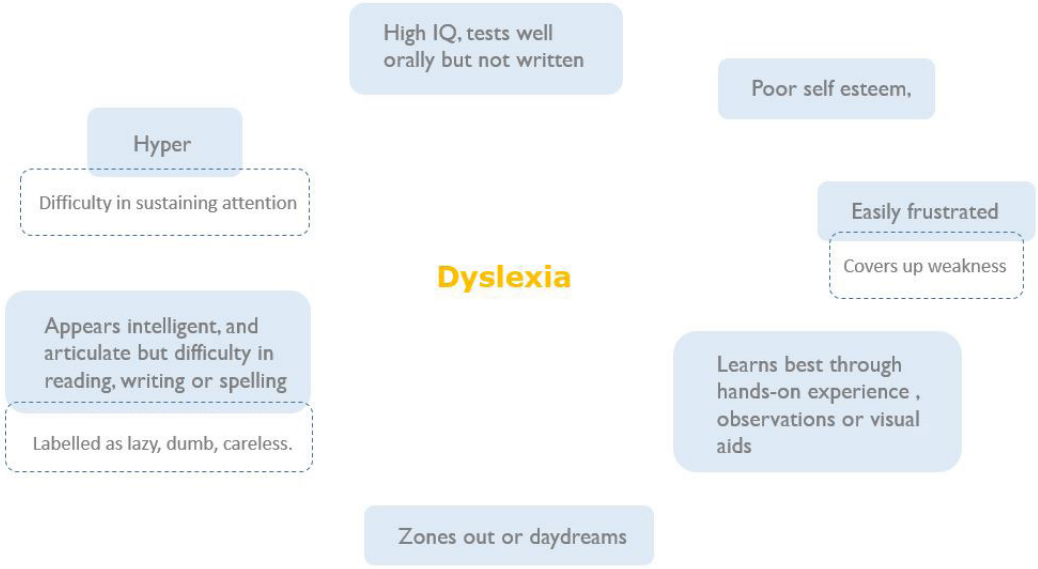
Reading and wrting , both these skills require **the ability to first recognize the letters in a word, then use these letters to identify the sounds and assemble them to make sense of the word**. Reading is decoding and spelling is encoding. Both these area come of as a daily struggle for dyslexics. To be a little scientific, It is the breakdown in the acquisition and application of alphabetic knowledge (phonology or orthography) resulting in slow, laboured reading.

This ability of joining sounds to form words is known as phonological processing. These phonological skills relate to a child’s ability tc master the sound/symbol systems involved ir reading in any langauge.

Figure on the right shows how the brain area active while reading are not activated in dyslexic brain and the area for speech is ove burdened.



Effect of phonoogical deficit on brain



Observed characteristics of dyslexic child

Traits and characteristics

I studied the documented signs and symptoms of dyslexia and also obsered them during the children sessions I conducted.

Dyslexics are very active and may appear hyper if Attention Disorders are also involved. This might make others label them as not working harder or cutting corners in class. They are average or above in IQ. It is well established by research that dyslexicsa are not scholastically retarted in any way but its just a learning difference.

Random zoning out is also an issue. These kids daydream a lot and have hard time keeping track of time and direction. They are talented in create endevours like art, music, dance, design, construction as they have high spatial awareness.

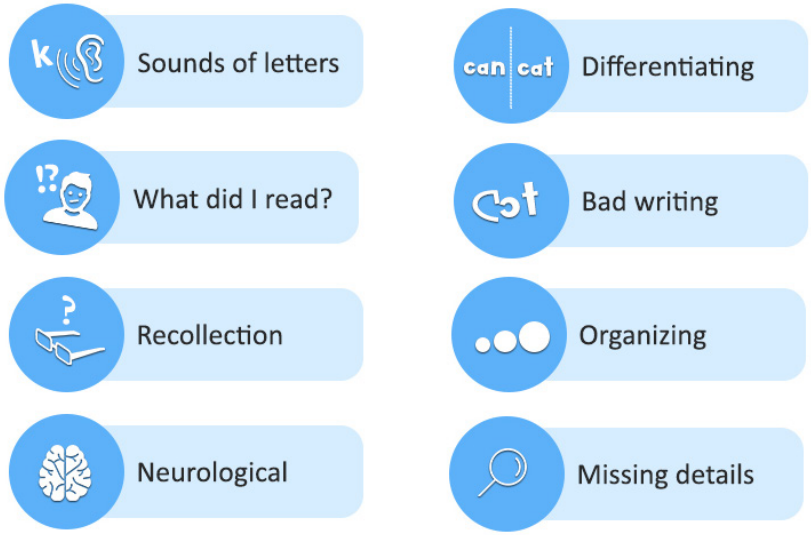
Hands on and any engaging approach is most effective stratgey for them as they learn quickly in such manner through observing and repeating tasks.

Broad spectrum of problems

The spectrum of issues are so broad among individual that it becomes hard to set a guideline for assessement. During the interview it was clear that the educator is describing problems specific to each child that attends remedial education. It was understood that the problems arise from difficulty with speech sounds and deriving meaning from them. But in the background there are much bigger underlying problems such as a lacking self image due to contant frustation and anxiety due to confusion in schools. These exacerbated by the inconsistencies of dyslexia as they often anticipate imdending failure and thus entering any new situation becomes anxeity provoking.

This leads to anger and a lower self image and feeling of inferiority. If this is addressed a lot of issues are wiped out and a strong foundation for remedial education is set. However if unaddressed by the age of ten it becomes much harder to develop a positive self image.

A cloud tag for daily dyslexia problems



Categorisation of key issues to be approached

Narrowing down the scope

After going through the document traits and observed ones, I tried to organise the problems into categories. These can be addressed through a remedial education and can be tackled to help children overcome difficulties and equip themselves with skills to aid in school learning

Dyslexia is a broad spectrum issue. It was felt that it is very important to narrow down studies for much more focused observation and insights in the next user study sessions. The issues are then approach by more intensive study which led to insights about how to perform learning intervention. The difficulty in writing and spelling, forgetting learn words, missing the minor details etc. can be addressed specifically through step by step approach.

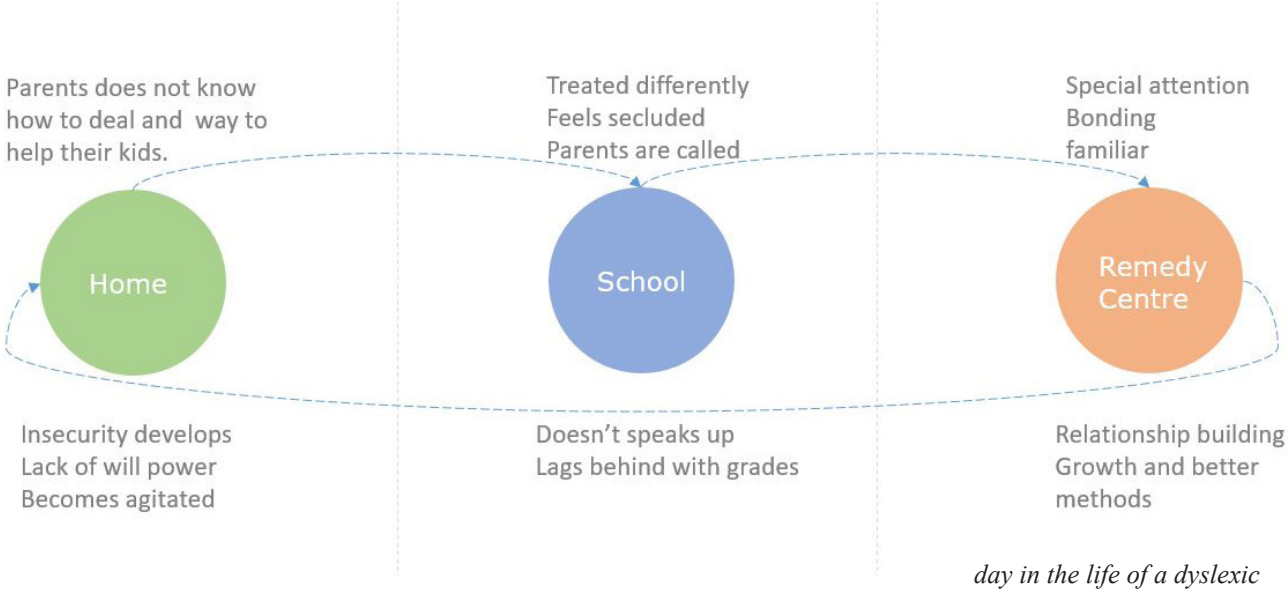
Encouragement is in the base of these categories. It support any intervention among these key issues and helps in achieving learning goals. One more point is the environment at home and the daily schedule of a dyslexic.

Mapping the day of a dyslexic

From my data collected from research, session, interviews and information from other sources a one day flow map of life of a kid was plotted. This is based on the observed day of a dyslexic child that goes to day school and then takes three hours remedial classes . This is almost true for all such kids who are dyslexic and go to remedial education on a daily basis. However this can vary in case there is no intervention.

At home, parents are uncomfortable in accepting this condition and often lack the access to remedial solutions. Also learning disablity is seen as social stigma due to lack of awareness in general public. Due to co-morbid issues such as attention disorder, parents think the child is mischievous and naughty. This makes the child more accepting of the situation and creation of coping mechanisms like frustation and anger when prompted to read or do homework.

At school there is lots of confusion and mounting peer pressure. When other students start noticing the disability the child becomes more self aware and gives in to anxiety. Its the teacher's turn at



day in the life of a dyslexic

this point to observe closely and do intervention. But in most of the cases the child is labelled as slow learner.

But special schools are the breath of fresh air in the daily life. They come to a place where they are understood and are taught in the way they understand. There is motivation and encouragement at each step and this results in close bonding between the teacher and child. The child misses the interaction with peers at school but one to one sessions are more effective.

Conclusion

Conclusion from secondary research more or less adds to the intensive user studies. More the **senses engaged** in learning, better is the quality of learning along with motivation. This was felt as very crucial to assist a dyslexic kid while tackling learning issues. **Positive reinforcement** is important as the child already feels secluded and different in most cases. Phonological awareness is the first major step in the long road ahead. Peer to peer learning among children is absent at special schools as the sessions are more private and one to one but it was felt really crucial under circumstances.

Study of research papers and existing resources directed me towards the possibility of creating useful content and a way to address issues at the very earliest. Early intervention was understood to be the main intervention point for design criteria.

It was established that the in order to address the key issues the approach will be inclined towards participatory design.

The educator, the parents and the school teacher need to be involved during any ideation and brainstorming on solutions. The children will play key role in deciding which way the solution will go ahead with their feedback.As user studies and interviews ran parallel to the project I will explain the details the interactions and insights are analysed through the interviews at verve centre in the user studies section.

Going ahead there are four main focus points:

1) Understanding the narrowed down categories and existing solutions to address them

2) Educator and children feedback on initial study conclusion

3) More close look at reading habits of a wider sample size.

4) Explore multisensorial approach to education.

Insights going forward

Children with dyslexia have very low confidence regarding reading and writing thus they are insecure while starting special education. They crave a strong positive reinforcement and bonding while learning.

Children are highly attached to their educator and responds to their ques and promts. So **educators inputs are very crucial in the process of design of any learning aid.**

Design has to be in line with child's current learning methods and they tend to be should be sensitive to it. For eg. Activity based, reward system, positivity and bonding. Should be put as a mean to strengthen what is being learnt.

Session with children yield common patterns of phonic approach that can be observed in day to day classes that shows aspects of multi sensorial approach of learning followed at remedial centers verve & MDA.

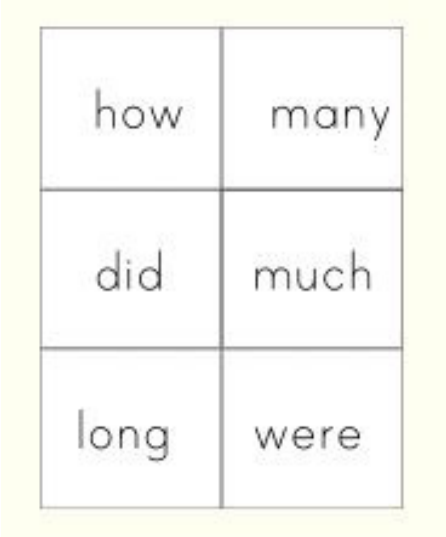
Observation of educator,child interactions during sessions resulted in the analysis that **encouragement and repetition is very crucial.**

Games like *picturika***(board game where educator and child take turn identifying similar picture and shout** *picturika* **everytime score is made) is repetitive .**

No quick remedy exists for dyslexia from any solution that is designed. The kids don't learn immediately from these. But with motivation, support, step by step approach and repetitive training the kid can mentally overcome his disability and become successful in life.

There should be a strong support for vocabulary maintanaince. It was observed that everday educator repeats old words and try to create contexts to trigger memory via opposite or rhyming words.

Teaching methods



Sight words, most frequent words, some of these do not follow phonic rules

There are certain methods that are used to best assist children with dyslexia. The following list is based on secondary research which is further explored during interaction with teachers at teaching centres.

'Look and say; method or sight words

There are certain words in english language which often do not follow the phonic rule and are the most frequent occurring words. These cannot be learnt through pictures and thus need to be learnt by just looking, this called sight words.

The phonic method

This method is based on auditory learning and is used most at learning centres as it addresses the core issue with dyslexia. The goal of this method is to help beginners learn new written words by sounding them out with repetition in a step by step manner that starts with understanding alphabet sounds.

Alphabetic multi sensory method

Children are taught alphabets by writing on sand. They are encouraged to feel the letters in order to complement the auditory method or any existing method.

Language Experience method

Children are taught to read sentences and stress is on experiencing the content which is usually gone in group activities. All four acts of reading, writing, listening and speaking are done side by side through step by step and involvement of each member in the group.

Case studies

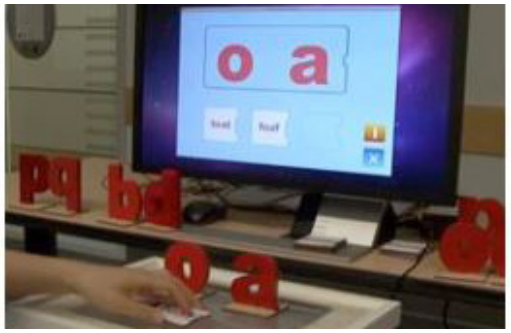
Existing works and technologies were analysed to understand the application criteria of solutions with any shortcomings while approaching dyslexic people. This lead to understand teaching methods employed in a better light and become more empathetic towards the struggle of children.

Picture it

This application is developed by Sandcastle technologies. It is a software that breaks down the sentence and assigns an image to each word. This is based on ‘look and say‘ method. Being a visual medium engagement is proper but struggles with correct representation.

Although very simple there is no attention to the core issues with dyslexia as it is assumed children already know the mapping between alphabets and sounds and know how to blend them to make words and associate picture with them.

Picutre it reading application



Letter	Object	Material
a	Apple	Shiny smooth paper
b	Balloon	Rubber
d	Dog	Fur
o	Orange	Leather
p	Pillow	Pillow cloth
q	Quilt	Quilt cloth

Tactile interfaces for learning

Tactlie letters : Alphabetic Learning for Dyslexic Children

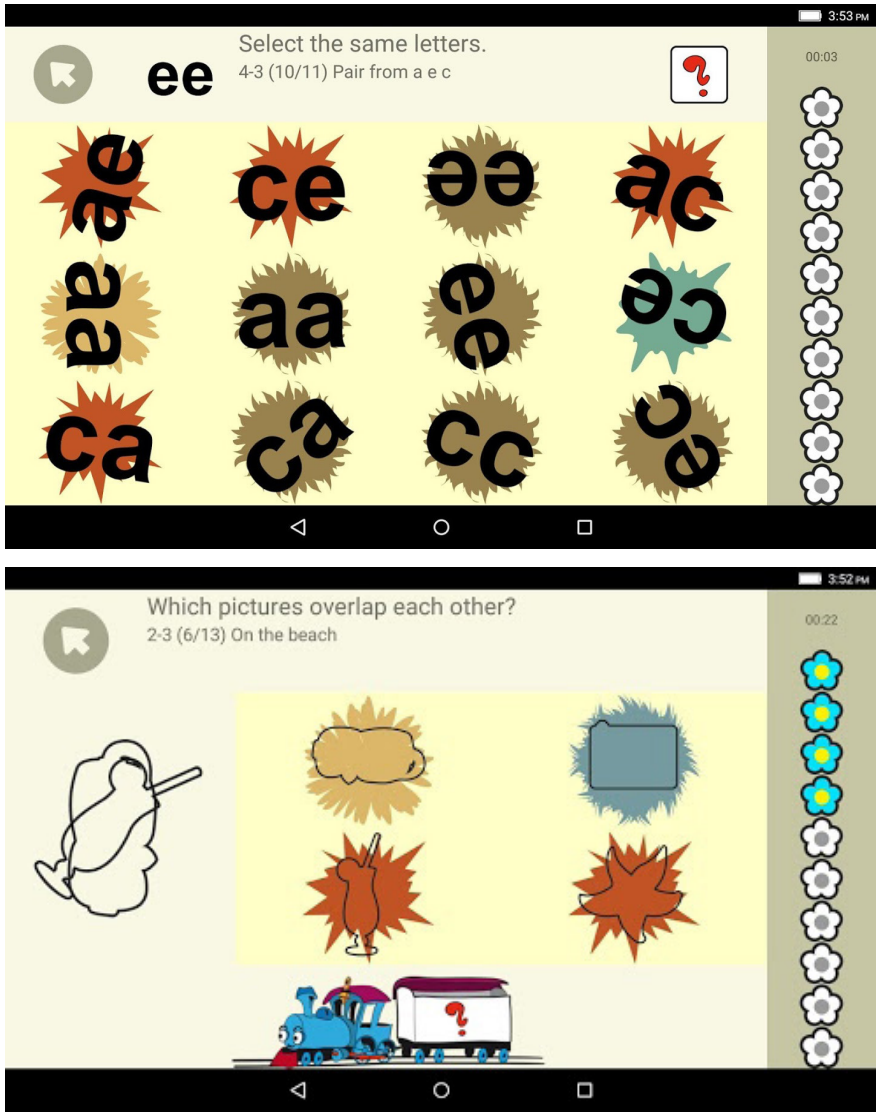
This is a design research project that proposes a tangible user interface and aims in providing multi sensory learing to dyslexics. This paper states that tangible user interfaces have the potential to support children learning to read as very few studies have explored how to help these special children to read.

Here they present Tactile letters, a multimodal tangible tabletop with texture cues. This is designed for the children aged 5-6 years. The system allows user to listen to letter sounds throught the system when the tangible letters with texture is placed on the table top. In this way the application targets all three senses at once, audio, visual and tactile. users can feel the smooth apple surface when the tactile letters are felt.

Eye games application

This androd application targets making connections regarding pictures, letters, shapes, and backgrounds. Positive reinforcement through simple animations provide a fun environment. Visual discrimination approach is followed to let child select matching letters.

However there is no approach to address letter sound association and spelling. The application only addresses on revision through visual discrimination for children with enough leanrning to identify and apply phonic rules.



eye games, mapping relations

Dyseggxia, teaches spellings to dyselxics

Dyseggxia

The application targets teaching spelling to children with dyslexia through exercises. The goal of the game is to produce correct words. The game consists of these following exercises:

Add a letter

Remove a letter

Change a letter

Put the letter in order

Split into words

The game lacks phonic approach though being very simple to use. It is assumed user already knows and has a strong phonic and complex word vocabulary.

Tiblo

Tiblo is a learning toy comprised of tangible interactive blocks that children can use to record their sounds and join together to make a story. The target age group is 8 to 12 years. It is specifically designed keeping in mind the psychological and emotional effects of dyslexia as children develop one to one relationship with their beloved toys.

The modular blocks can pre-record 10 seconds of sounds clips and can be attached to another block which can used to make different shapes. It is a learning aid which uses sound in conjunction with visuals to help the child remember and follow sequence based instructions like in a story or spelling.

Apart from the sound recording feature the aid is passive and requires student interest and motivation to bring engagement.

Electronic blocks can be attached to each other and record sounds

Conclusion

Quick note and design implications going forward to ideation.

Interactive aid in the case studies revealed that technology has had a very strong impact in the wasy education is consumed and it opens many new dimensions and ways of imparting instrctions that were earlier not possble. However it very important to understand the emotional and psychological aspects of dyslexia and design the solution while empathising with the traits and behaviours of dyslexics. Failure to do so results in a standard reading and learning lesson that adds to no value in the ongoing struggle of children.

Main Design implications :

1. Indepedent learning

2.Reinforcement

3. Educator involvement

4. Focus on repetition

5. Fun a yet productive interaction model

6. Reward any completion and attempt!

7 Reinforce concept repeatedly.

Restated brief

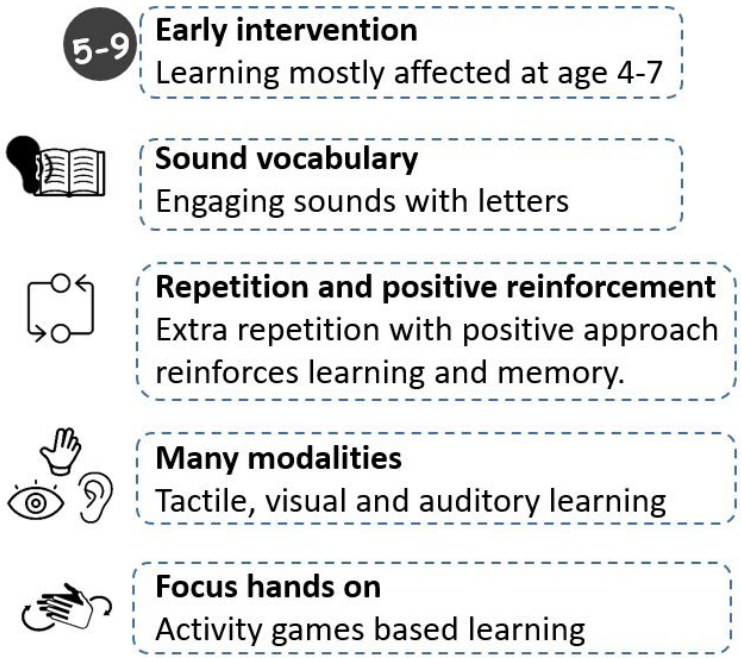
Based on the study of the methods that are currently used for teaching children with dyslexia, interviews with educators, observing kids, and considering the mindset of the dyslexic which is very visual-thinking and inclined towards multi sensory approaches in instruction, the obejtive is to create a play and learn environment for dyslexic children which engages them with positive reinforcement and motivation and makes them feel comfortable in learning in their own pace.

The goal of is to teach reading and spelling to dyslexic children of 5 to 7 years of age, using structured and engaging learning content.

The projects aims to seek
following contributions:
1) To assist in dyslexic learning while reducing overall time to grasp and organize lectures.

2) Help children gain interest in reading and make learning engaging, fun , yet productive

3) Help children take control of their learning. Make them take initiatives in learning . A system to track progress.



Ideation criteria

Ideation

I defined key design considerations to base my ideation on:

1.Early interventon

2.Sound vocabulary

3 Repetition and positive reinforcement

4. Many modalities

5. Focus on hands on interaction.

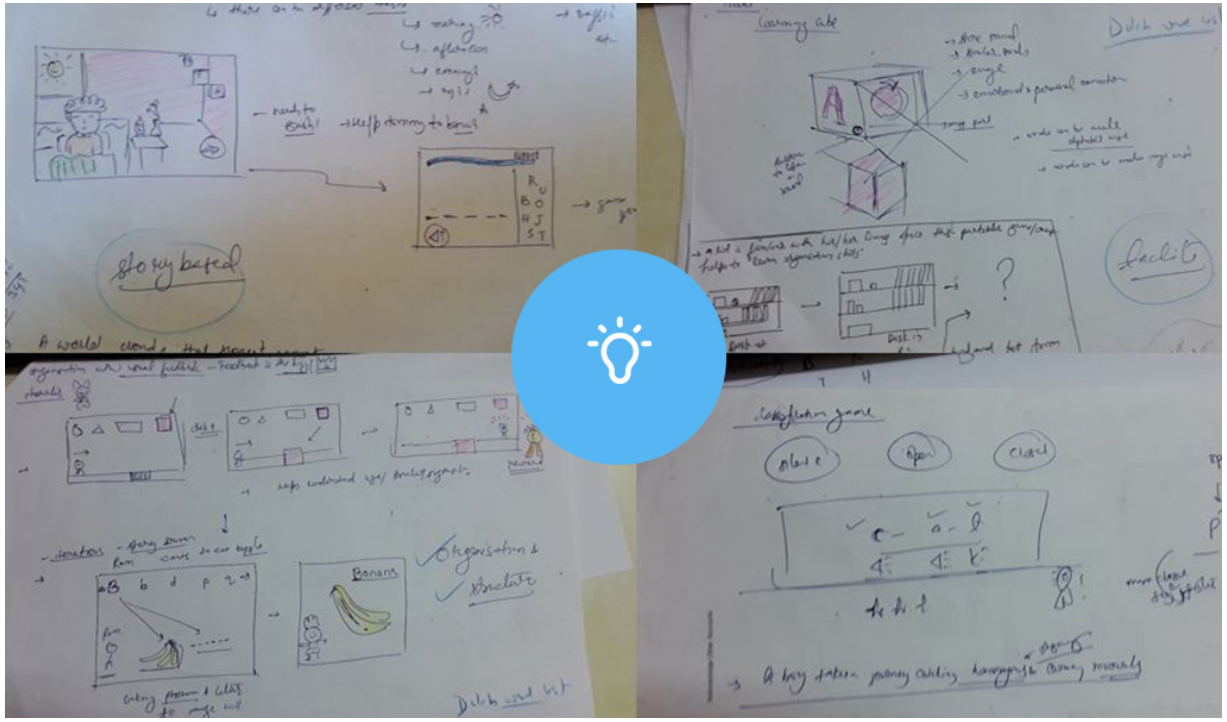
To start ideation techniques that were proven to help dyslexics reading skills were examined and Interviews and meetings with educators and session with dyslexic kids yielded the criteria that needed to be included in ideation.

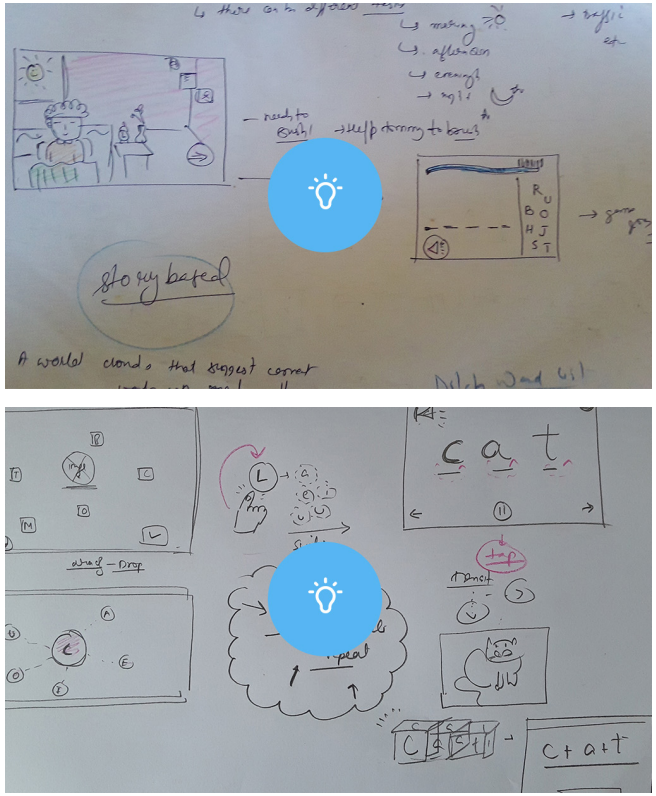
The concepts were tested with children and feedback was taken to create soft protype and mock-ups which were again tested with the children.

Ideas revolve around-
Motivation and building confidence.
Learning sound and symbol association.

Early ideation

I stared the ideation with most favourite tools of the trade, pencil and black paper. I sketched a dozen ideas. With initial out of the box approach I refined the sketches to align with previously mentioned ideation criteria. I further created few mock-up screens and soft prototypes for building first interactions so that children at learning centre can use and I can get the very first feedbacks and an idea of the direction I am going ahead with.





Concept 1, tommy's day

Concept 1, Tommy's day

Exploring letter sound and word interactions

Learning objective -A level based game that helps in learning how to blend sounds to form words. Kids will explore and learn phonics and association. Issues with letter sound blending through daily routine in child's home environment.

Pros – familiarity makes the child ease up before starting the application.

A quick mockup was designed and testing with educator and chidlren for feedback.

Kids will find syllables in a word. This concept aims at teaching them sounds in a word by chunking word into syllables. On tapping a letter , a vowel cloud appears and user can make sounds. Step by step the word is completed!

Correct match gives a feedback in green color and the letter goes dim with a sound feedback.

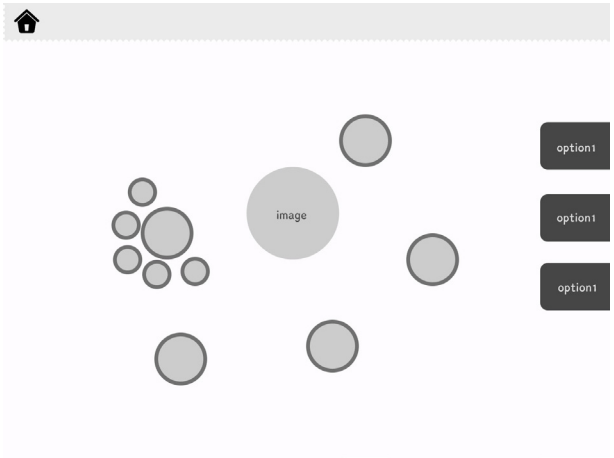
Assumption : kid already knows phonics and is learning how to blend

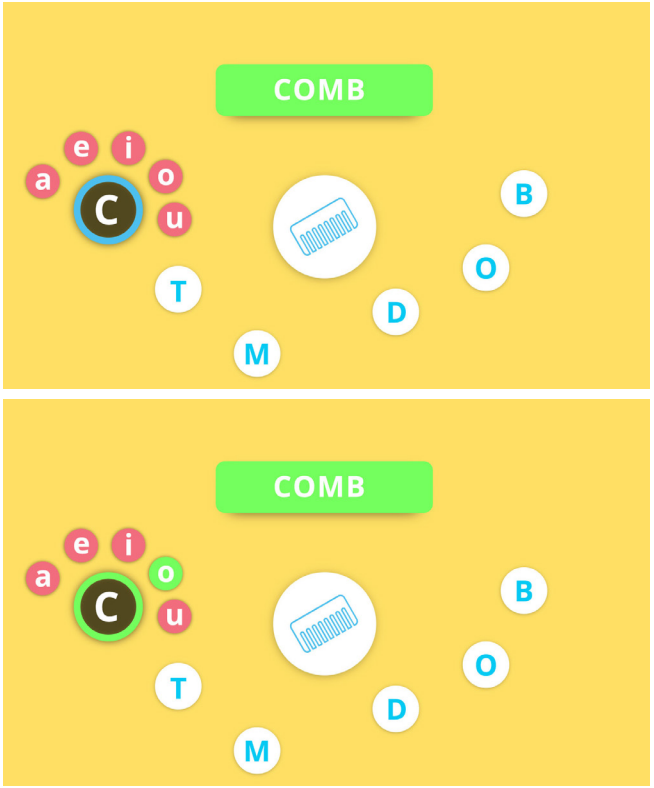
Concept feedback

Before showing to children and taking their feedback , educator was consulted with tis concept. the main feedbacks were: Introduce a vocab section. There has to be a vocab section where the child can come back to revise. Strengthen the context by intruducing opposite words or similar words etc.

Bring attention to shapes.

Display shape of letters or words for visual discrimination and better memory





Quick mockup creation for concept testing

Rapid Prototyping

Quick prototyping

Interaction and feedback session with children

Test criteria

Children were given the soft prototypes without the instruction of how they were supposed to be used and the response were observed. There hand movements and questions were noted. Also teachers were asked how they would incorporate the concepts in their daily schedule classes to understand how and where the ideas would fit.

Scenario for test

Tanish is a student has reading difficulties and has just started with remedial sessions. He doesn't enjoys books and is often makes faces when teacher asks to start reading simple letters.

He hates spellings. Teacher did something different and asked him to name three objects he uses in the morning, Tanish replies, brush, soap and comb. This time she gaves an interactive tool called 'Tommys day' to Tanish and aske him to make the word comb. Tanish listen to the sound of the individual letters . <C> <O><M><B> and started to interact with the application.

Observation

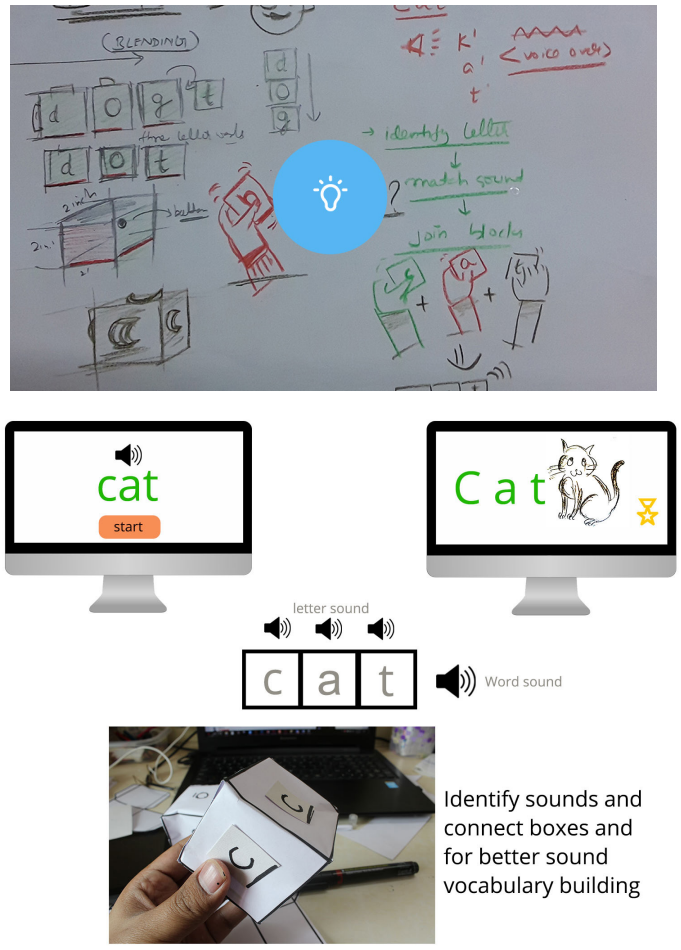
the first words from kids were *"I need to make a word!, let's see, bhayya! where should I put these lettes?"*

1. Children Immediately went for the letter circles and started tapping them. However there was no urge action to drag the discs on the central picture. A simple tutorial animation would be helpful to start.

2. Confusion with the random arrangement of letters, child thought there are two words to be made.

3. Child had to be instructed that the surrounding vowels discs have to be dragged inside the letter circle. Audio feedback is needed at each tap.

Children interacting with paper prototypes.



Concept 2, sound blocks

Concept 2, Sound blocks

Exploring tengible interfaces to help learning sound vocabulary

This concept will help the kids identify letter, sounds and learn blending. This adds one more sensory input as tactile and brings kids into a hands on activity which reinforces better memorization of concepts. Eg. Writing on sand. Clapping hands together to chunk.

Sound blocks with protruded edges with texture. When shaken/pressed make sounds of the letters represented by them. When joined to make a word, application motivates and encourages. The blocks can be arranged to form many words/phrases to **teach identifying, spelling and early reading skills with overall better sound vocabulary.**

Concept feedback
Word introduction needs to be at random. Dyslexics normally tend to cut short and pronounce all words with similar endings as same ,If cat is introduced , last sound is –at. if CAN is introduced next they will still spell as CAT.

Interaction and feedback session with children

Test criteria

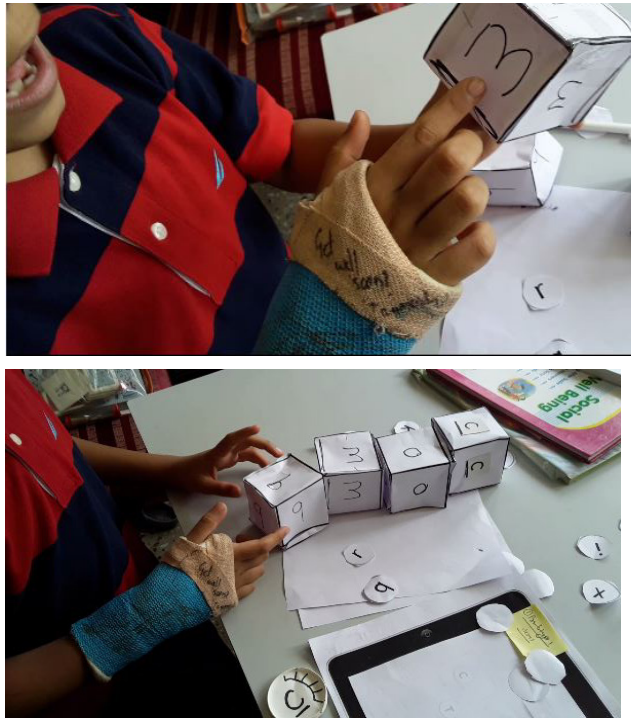
Children were given the soft prototypes without the instruction of how they were supposed to be used and the response were observed. There hand movements and questions were noted. Also teachers were asked how they would incorporate the concepts in their daily schedule classes to understand how and where the ideas would fit.

Scenario for test

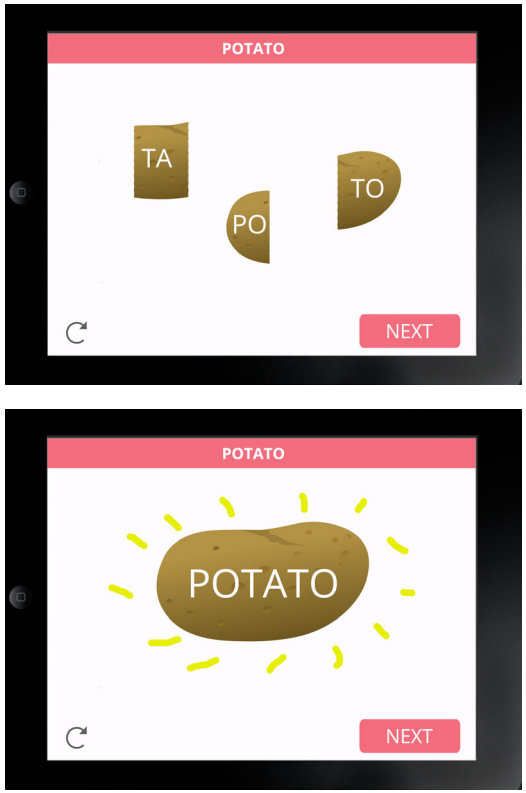
Amir loves hands on and often plays with his action figures during class. He often shys away from spelling and leanring new words. This time teacher found a new way to manage this. She gave Amir some cubes with letter on each side and asked him to name his favourite action hero. Amir took the cubes and started joining them but as he is dyslexic he has trouble with letter symbols and their sound interpretation. He shook the boxes and out came the sound of the lette! ‘C’ voiceover – ‘kk’. He loved it and started exploring more cubes.

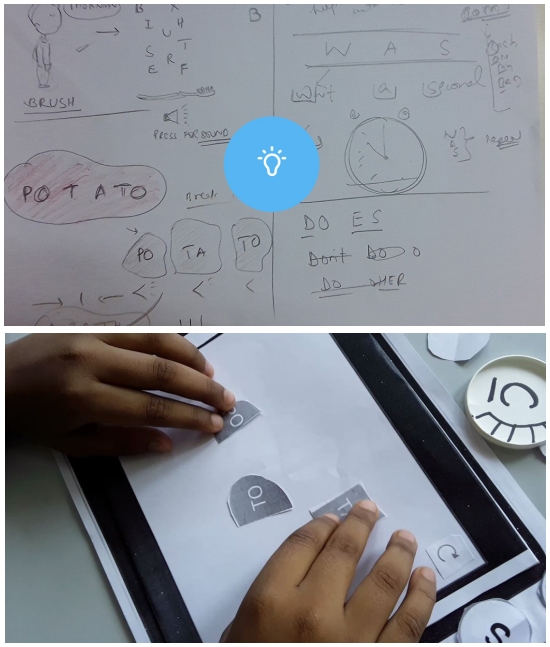
Observation

Cubes are intuitive for stacking up and making dictated words. As this was a paper prototype incorporating an audio feedback is needed to test accurately. Children were able to form 3 letter words easily. Many positions were explored, vertical and left to right and top to bottom. There needs to be a direction or a shape to guide how to join to boxes for a particular letter or challenge.



Children interacting with paper prototypes.





Concept3, using Mneumonics for better reading

Concept 3, Mneumonics

Learning objective -Manipulating images for blending -Words are chunked in the form of both images and individual sound. When joined together they help in better retention of the word memory by context created using both pic and sound.

PICTURE+ACTIONS > SOUNDS+LETTERS

Chunking a word into syllables/phonics and using a visual aid or imagery and couple them with an action or puzzle. This helps in memorizing the sounds of the word.
POTATO >> voiceover<potato, PO ...TA..TO...>
Child claps three times with teacher while spelling out the styllables.

Concept feedback
Syllable revision can incorporate this Interactive activity. Both teacher and child can take turns.
Den – tist, Cat- Nip . Educators stated Nouns or other parts of speech are introduced much later after there fore use simple words at first. Normal way to go with dyslexic is ->Decoding sounds – reading – fluency – comprehension - grammar.

Concept 4, ‘Spell’ tree

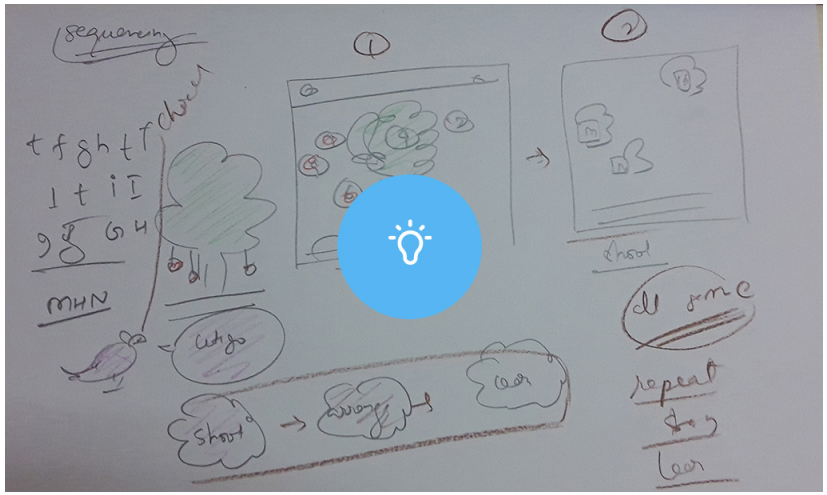
Learning objective

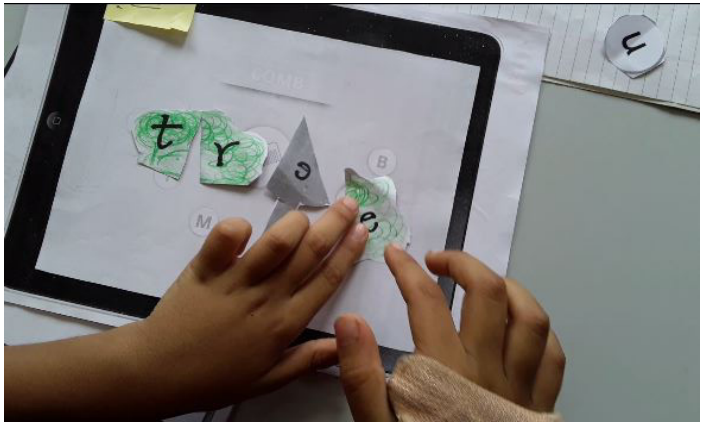
Aim is to learn sequencing through number of alphabets. This can further include sound identification through stages. Also directionality confusion will be addressed.

Children with dyslexia often confuse similar looking letter shapes and words, especially those that are a mirror or reversal of one another, e.g.. b’s and d’s, ‘was’ and ‘saw’. This concept aims at helping in writing and identifying and also sequencing correct letter, word or number through visual discrimination. Though displaying <t> and then making a hand gesture to the right side!

Concept feedback

Use as revision exercise is best. The bird character should should give audio feedback to engage. Reward any correct score and then followed by a contextual lesson to reinforce me. Use slight animation to follow letter form.





Children interacting with initial prototypes.

Interaction and feedback session with children

Test criteria

Children were given the soft prototypes without the instruction of how they were supposed to be used and the response were observed. There hand movements and questions were noted. Also teachers were asked how they would incorporate the concepts in their daily schedule classes to understand how and where the ideas would fit.

Scenario for test

Rishi loves plants and he wanted to learn about trees that day. Teacher gave him a tree themed application and with the task to identify the correct letters in the word. Tree. The story engagned Rishi and he soon was able to identify all the letters and was able to differentiate between similar looking letters with chunking the image and he also made friends with Tihi the blue bird! Tihi gave rishi new letters and hid them all around the trees they both played together and explored new sounds of words.

Observation

Were excited with the bird character and asked more question about the bird. Teacher and I did sounds for audio feedback on tapping on screen.

More activity was desired from the teacher after successful identification of ‘t’. The jumbled images were accepted as an after activity following the exercise.

The make tree and potato picture whole again was fun and was welcomed with added challenges of flipped letters. The teacher added by teaching them about syllables.

Educator feedback is include child’s vocab diary section that stores the words he spelled correctly and learn more about them through context like opposites or etc.

Concept 5,Writo

Learning objective

The teacher can set different words to write or spell exercises and kids can do them in their own time and learn with the application.

The kid will trace the word and if there is a wrong tracing the system will reset the word and kid will start again.

The size of the font can be increase or decreased based on difficulty level and so it can be dimmed if the kid excels in further exercises to get more expertise

Help section provide audio and contextual use of the word. This exercise will increase not only the writing proficiency of the child as dyslexics have often trouble with but also let me do this in their own time and speed.

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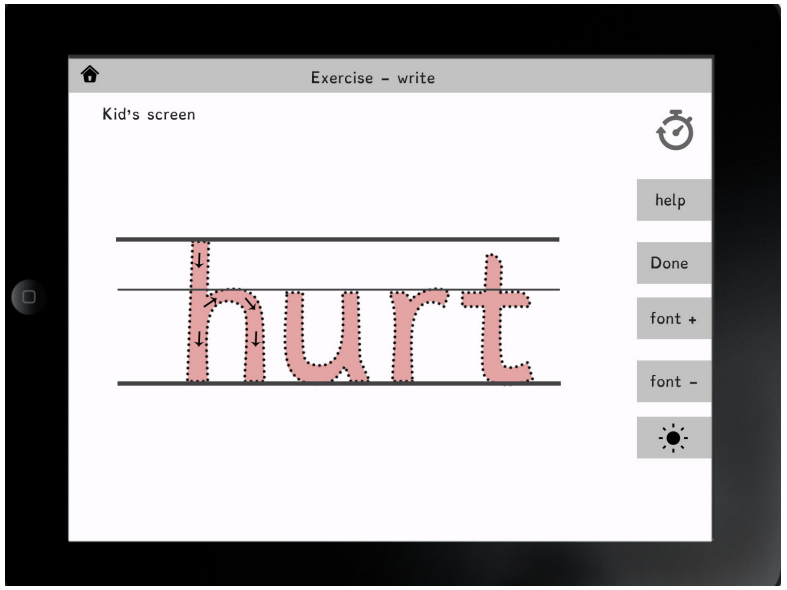
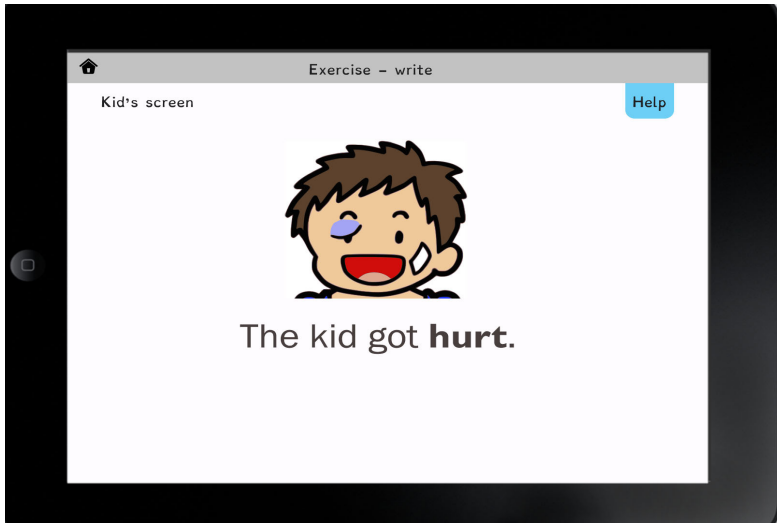




Design iteration

Incorporation of all feedbacks

The concepts were decided to be employable both as a standalone applications and also linked to daily teaching scenarios. The bird character will be omnipresent in the application and will be a teacher, friend and guide.

It was decided to further Concept1, Tommy's day concept and mnemonics concepts to be included in final design criteria.

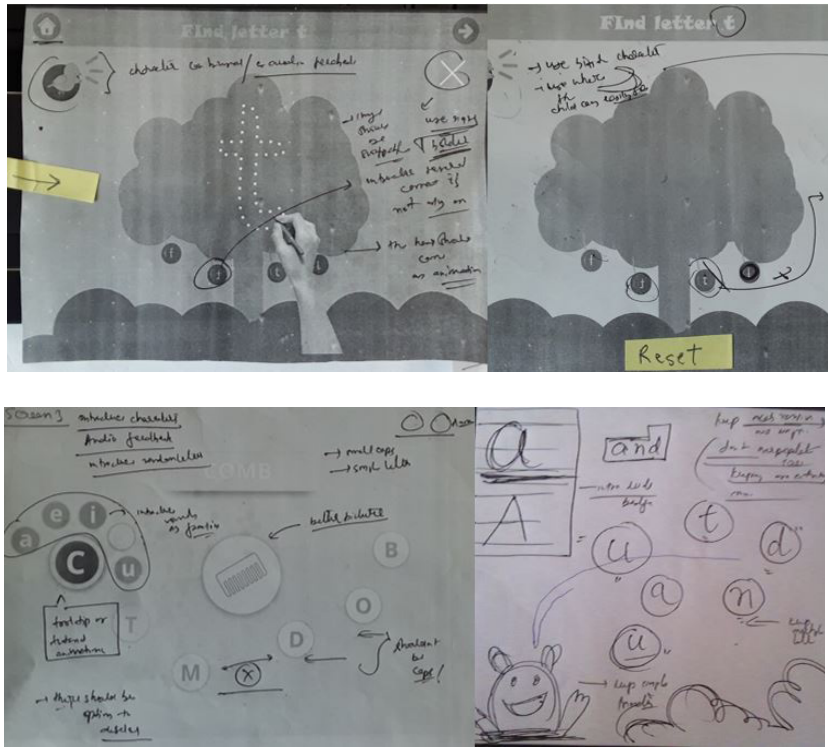
Target for evaluation is kids with dyslexia who have just started blending consonants and vowel families. No doubt the aid will be very vast and will include many things but for the sake of evaluation I will only focus on a specific task of learning. Educators will be able to employ parts of the application as per their and child's use to reinforce certain concepts. Other aspects is thought to be the pat of the bigger application.

Back to users for feedback

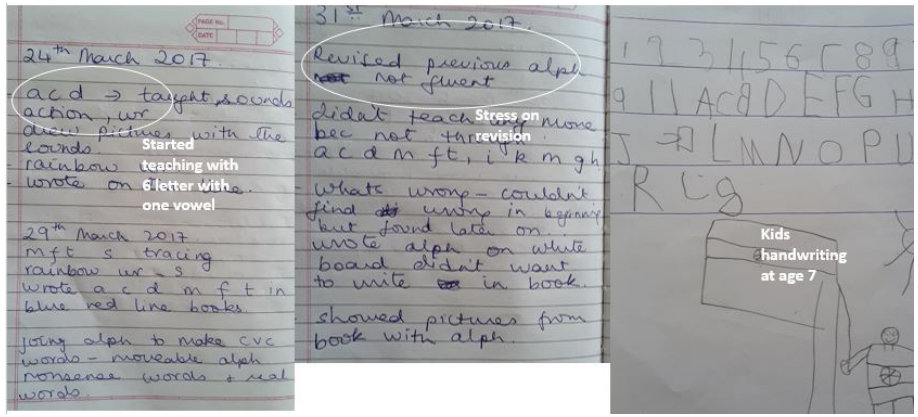
feedbacks were collected from professors and educators with kids sessions and the prototypes were edited and turned into better flows with easy use of learning concepts.

In this iteration key points were:
Characters should be personal and don't use a timer, it creates anxiety. User clearer and small case letters. Usage of high contrast colours for better visual hierarchy was considered.

Concluding feedback
The remedial education is not meant to force lesson plans on kids to read and write as they are already struggling. Any aid for dyslexics need to adjusts to kids speed of learning. Each dyslexic has own learning pattern and even while following a structured phonic approach , there is no lesson plan and new things are introduced as child learns, step by step.



Concepts were again refined based on feedback on early prototypes



diary of a seven years old who has just started remedial education.

Observation of lesson tasks or evaluation target

Current learning sessions were tracked at verve so that the final design can be tested with live lessons so that some value can provided during the remedial education which can be in turn evaluated for results.

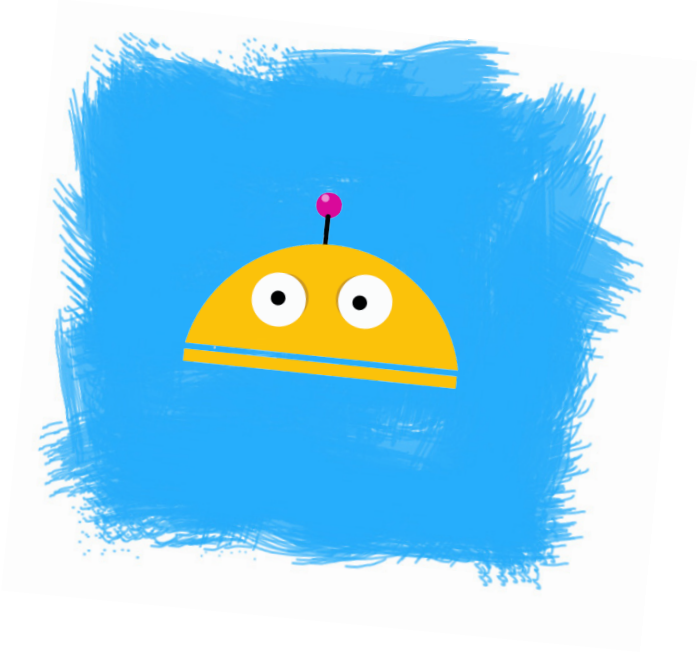
Main target learning : To create strong foundation for dyslexics children to build there reading habits.

Learn letters through sounds

Learn how to blend the sounds to make bigger sounds and then words.

Spelling

Blending of CVC words. Consonant-vowel-consonant e.g.. Bag, hat, sit.



Final Design

During the last sessions, the most important remark from Namita Mam was, “The remedial education is not meant to force lesson plans on kids to read and write as they are already struggling. Any aid for dyslexics need to adjusts to kids speed of learning. Each dyslexic has own learning pattern and even while following a structured phonic approach , there is no lesson plan and new things are introduced as child learns.”

After multiple iterations and feedback sessions, going ahead with ideas from concept1 and3,4 as my base for final prototype as it highly addresses the insights from my research and feedbacks and includes engagement with easy learning and targets the issues with dyslexia in a way that makes the concepts learnt easy to memories and retain.

Form - Tablet,

Application target - Assistive learning aid

Challenge – Activity - Conclusion - Next

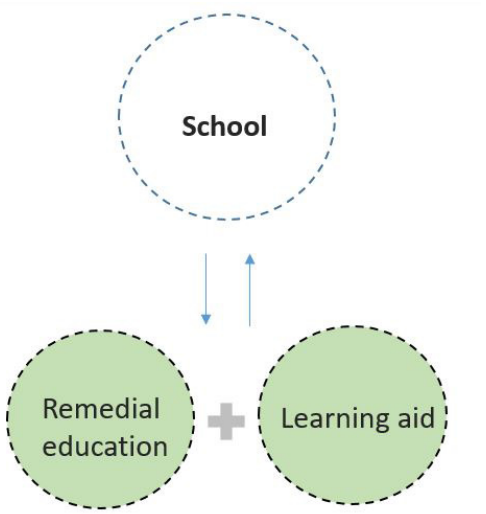
Approach

STORY > INTERACTION > CONCLUSION

The application will be incorporated as a medium during remedial sessions to reinforce memory for sounds through play and learn. Based on a familiar environment and introducing objects in child's environment sound and letters and their relationships will be taught. The application/game will be a part of a bigger environment where more activities can be included by adding challenges with the story.

The final product will fit in the intervention area where it can be used as part of the remedial education to strengthen the reading skills of children.

Final design will be employed and tested at the centres during sessions. the target section is during and post intervention



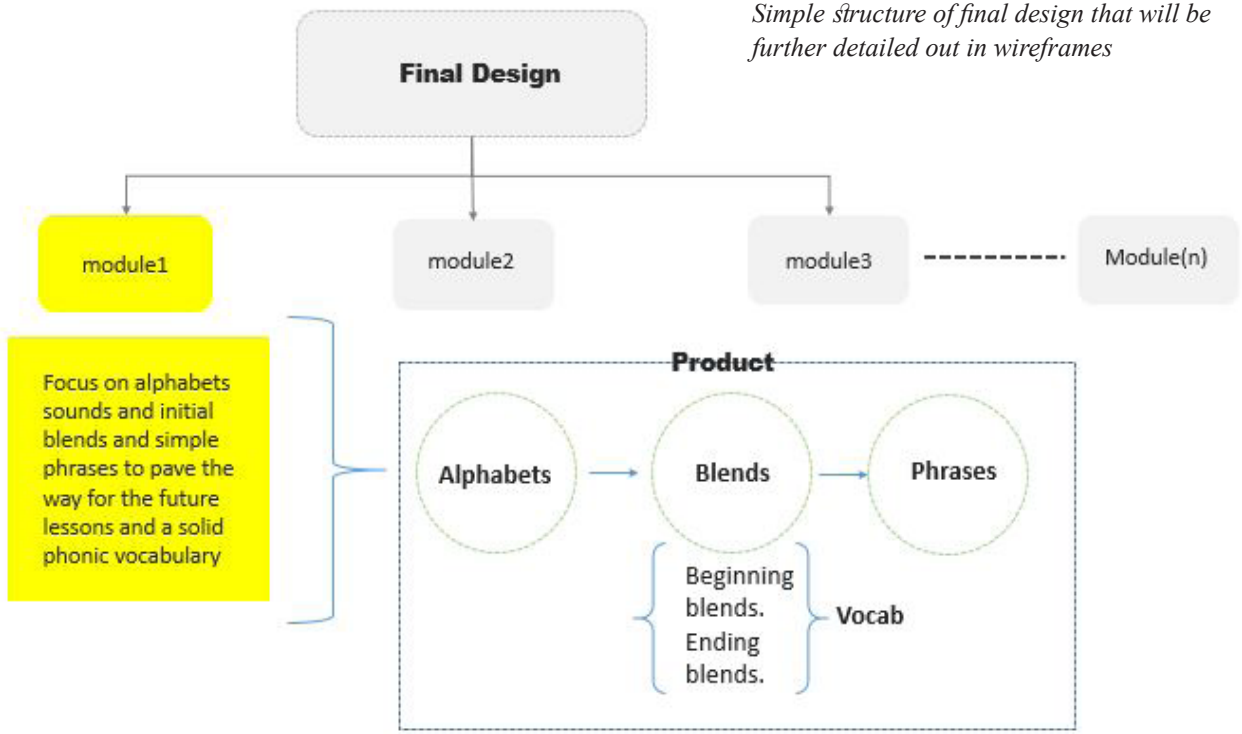
The outcome can further become part of a bigger framework.

Possible application

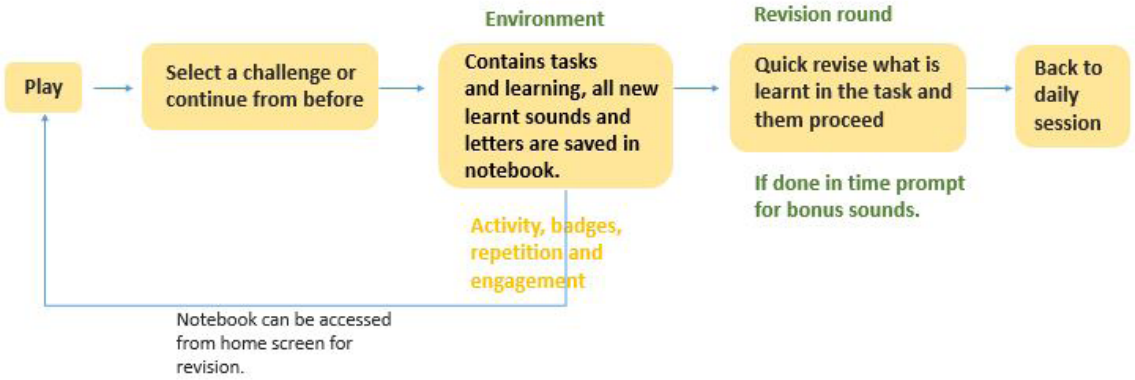
Possible reach of the prodcut will be in order to become part of a larger suite that can be installed in the computer classes at special education centers and will help dyslexics strengthen their reading and writing as they cope with school curriculum and special remedial education off course with special educator's intervention.

Educators will use the application to help children practice and thus foster an independent medium where child can learn and progress can be shared with parents.

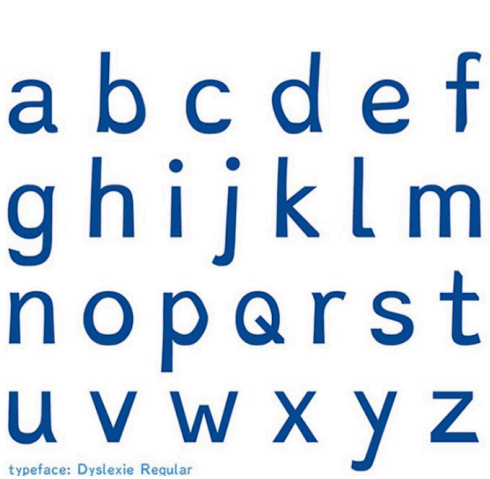
Simple structure of final design that will be further detailed out in wireframes



Entry point and task flow



Dolch words



Dyslexie font

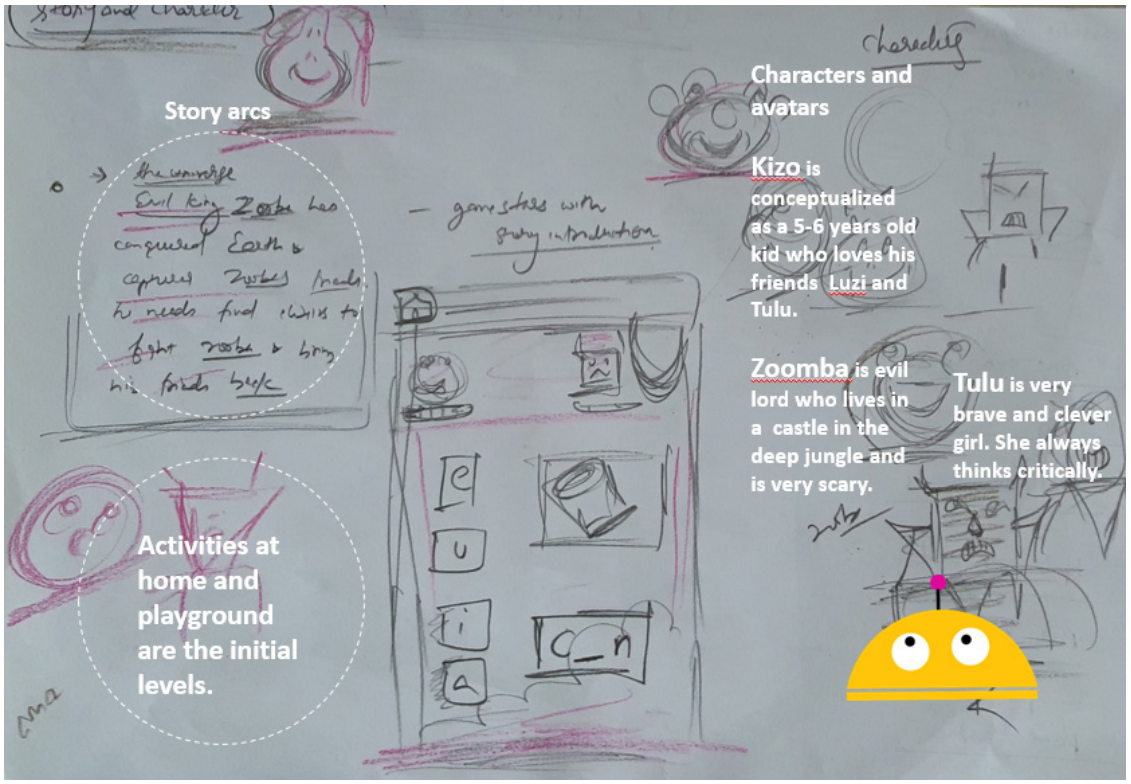
Word and Font selection

High frequent words that are part of day to day life. These are most popular words selected by educators for dyslexics that are cover more than half of words kids should know. Practicing them makes reading much more easier and fluent

The Dolch Word List is also called Sight Words or The Dolch 220. It includes the most frequently used words in the English language. Sight words make up 50 to 70 percent of any general text. Therefore, teaching The Dolch Word List is a crucial goal of education in grades kindergarten through 3.

The list is divided into grade levels. The basic list excludes nouns, which make up a separate 95 word list.

For font selection, Dyslexie font is choosen whihc is specially designed for dyslexic people to read easier and understand the letter easier. The font has various thickness in its linesmaking it more distinguished from the other letters and alsothey are made bold at the bottom.



Character and story exploraitions

Final prototype

Feedback was incorporated in the mockups and with final input from educators a need for designing with individual learning speed was understood. Using concepts 1,3,4 as base the final prototype will be realized and then evaluation will be conducted at verve center.

Story character and tasks

Kizo is conceptualized as a 5-6 years old kid who loves his friends Luzi and Tulu. **Zoomba** is evil lord who lives in a castle in the deep jungle. **Tulu** is very brave and clever girl. She always thinks critically.

As the application starts, the story and characters are introduced in sliding cards interaction. Then the kid meets robu, the friend and guide. Robu takes Kizo to his room and they both play together identifying sounds and reading them out to collect phonic badges. Suddenly Robu receives a message from Jeko the wise that his friends have been kidnapped by evil Zoomba, the phonic horder . Kizo with Robu set out to fee his friends and defeat Zoomba. They need to cross the river of sounds and the mountain of phonics to reach

Zoomba's castle. Jeko the wise give revision of activities as they proceed to reinforce the phonic lessons and power boosters.

Each lesson follows the theme of an adventure to reinforce and motivate kid to learn

Also, in addition to a coherent application wide story, each task in a lesson will have its own mini story. For the benefit of evaluation I am conduction evaluation on tasks based on following stories.

Story 1

Evil Zooba has conquered the earth and captured Kizo's friends. A wise saint tells Kizo about the elixir of life that will defeat Zooba. Kizo has to go on a journey to find the elixir in order to defeat Zooba and bring peace to the word.

The activities will be embedded with the story line as which only proceeds when the goal of learning in the task happens with revision and vocabulary building.

Story 2

Kizo wakes up in the morning. To earn a super badges he has to identify sounds and complete simple words to move to next level.

Kids can select different environment and hunt sounds in them.

Each story targets following goals :

Utilize familiar spaces.

Phonic building

Engagement

Learning

NOTE :

The working of this story model will be tested and based on feedback the application will refined and redesigned. As the application can stand by itself in a gamified version too. The both version will help in conducting AB testing.

Robu

Zooba

KIzo

These characters will be omnipresent with the little interactive robot that guides through tasks

Tasks are compiled based observations during user studies and focus is on repetition with sounds and positive reinforcement :

1) Introduce sounds – at home, playground.

2) Read sounds

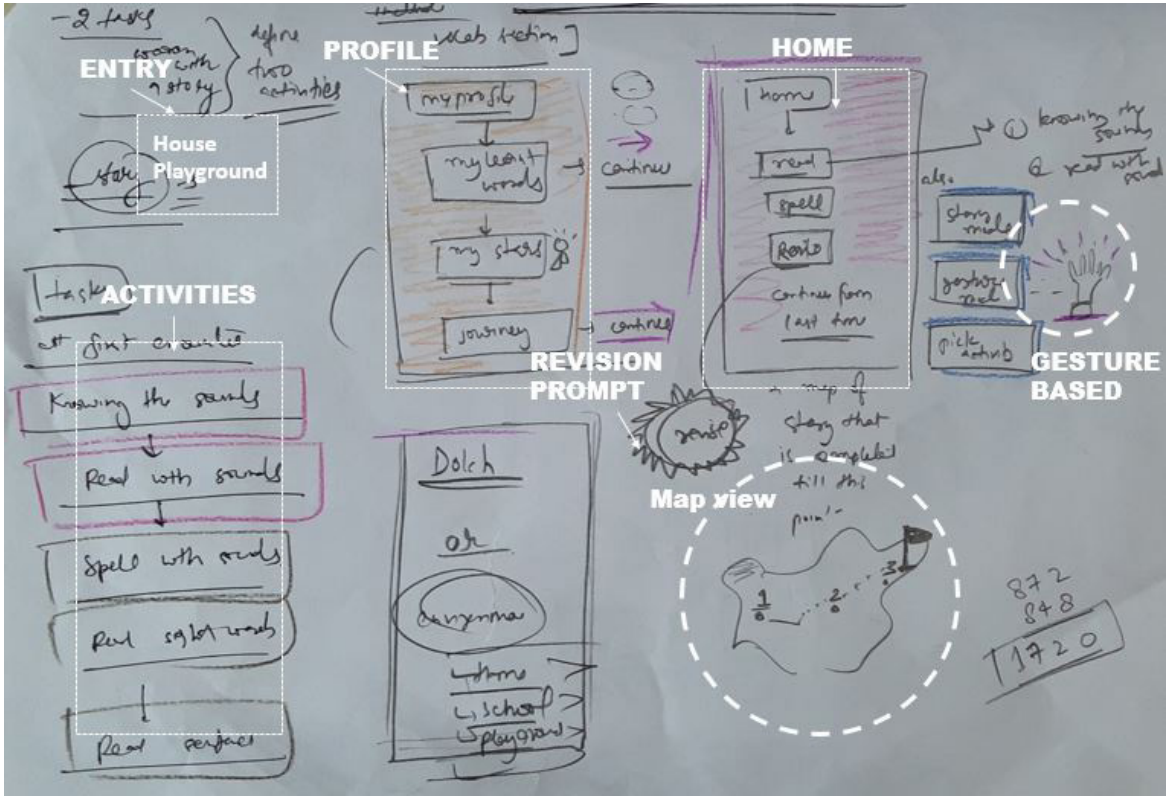
3) Spell sounds

4)Introduce more frequent words (dolch)

5) Spell sight words

6) Read more complex sentences or phrases

Flow of a lesson inside the application, each task is followed by revision tasks and going through kids vocabulary to strengthen reading skills as the next lesson begin

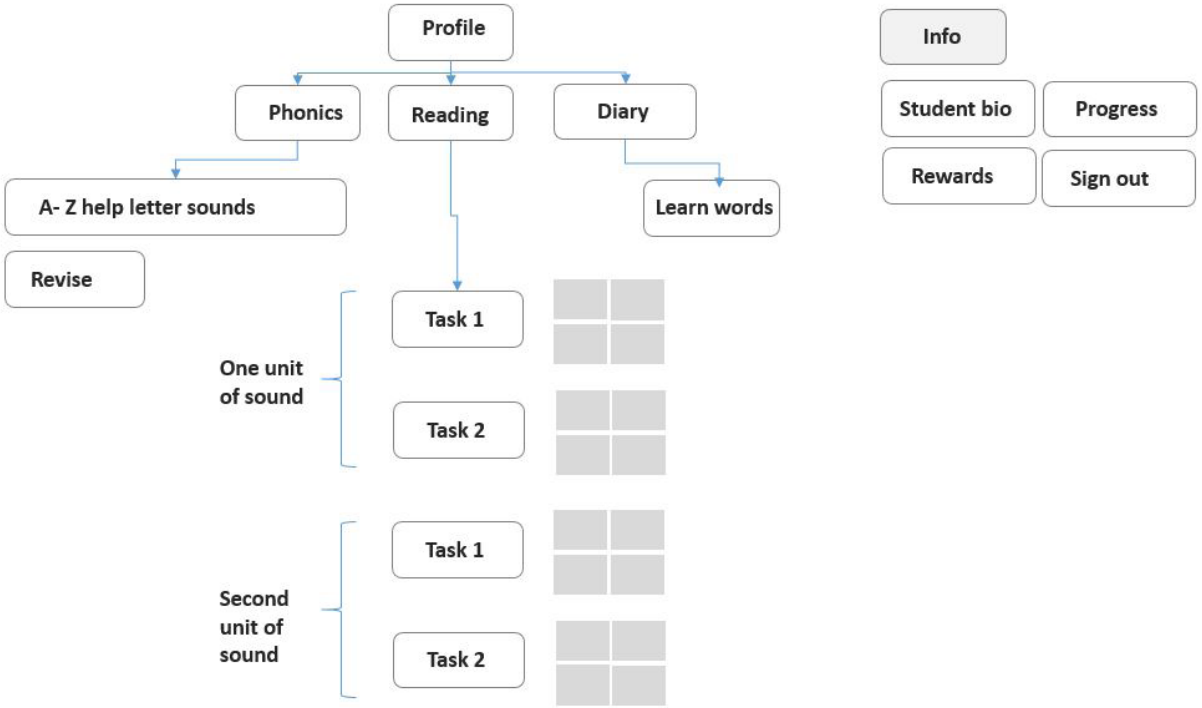


Designing the information architecture

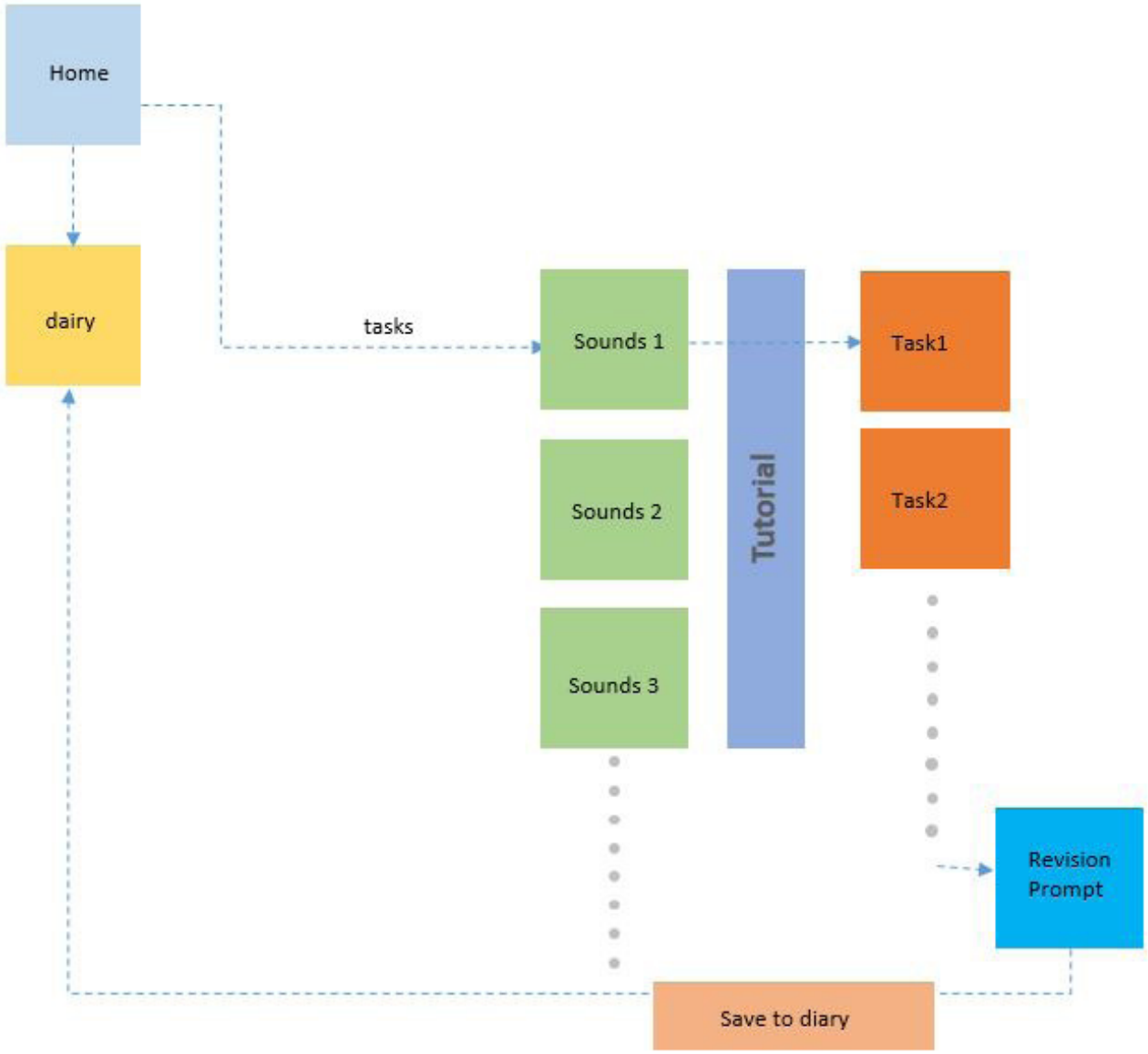
Information architecture

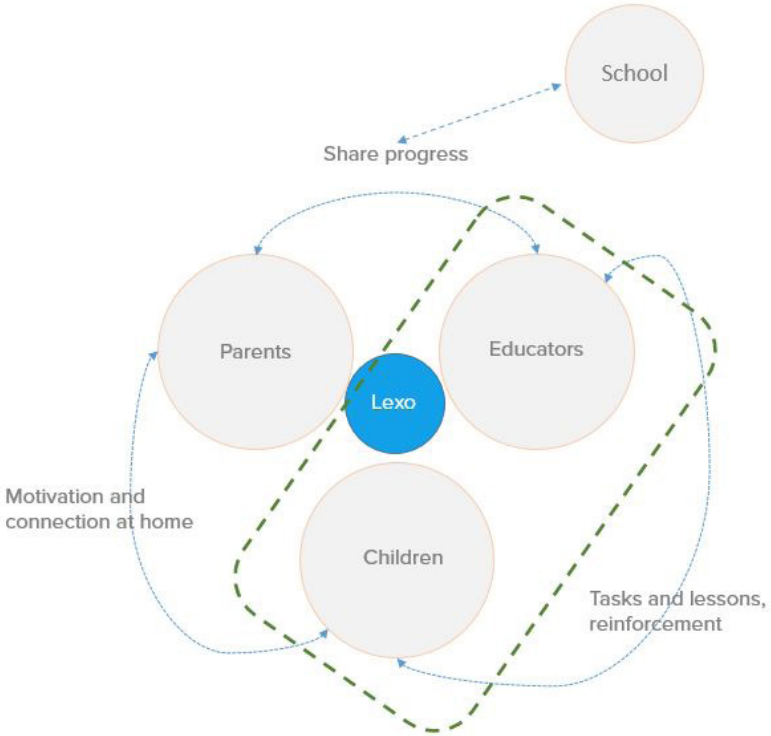
After establishing story and lesson planning, system architecture was brainstormed. As observed in past prototyping sessions it was seen that children immediately want to explore an application or game and hence it was taken as a design insight that the structure should be intuitive and ready for interaction at the very start of the application.

Early shallow IA to keep navigation easy

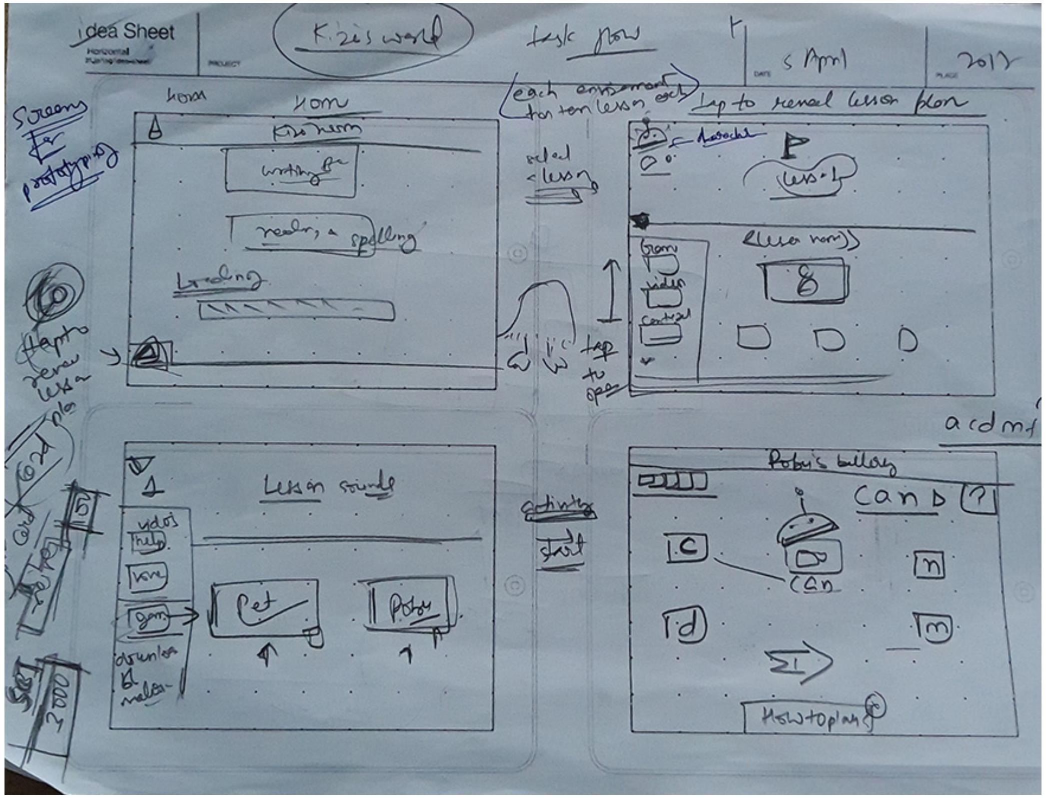


System task flow architecture





The ecosystem will be connecting parents , children and educator . Teacher will keep track of child's progress at centre and parents at home, they will share child's progress with each other and the assessment will also help in keeping child's progress in check with school. The child will feel more in control of his learning and will grow with the lessons. In my final prototype I am focusing on the area under green dots.

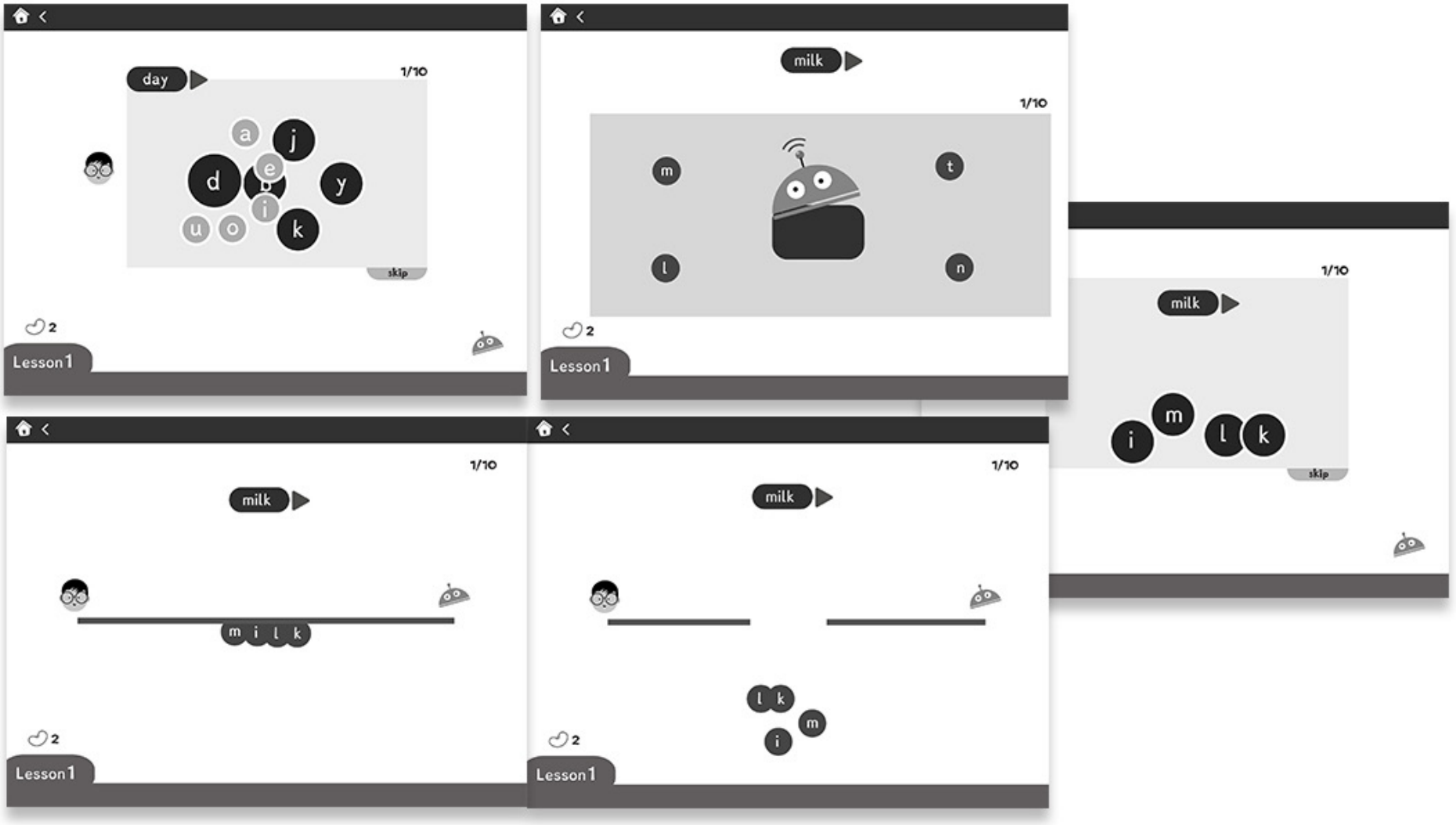


Final sketch after many iterations

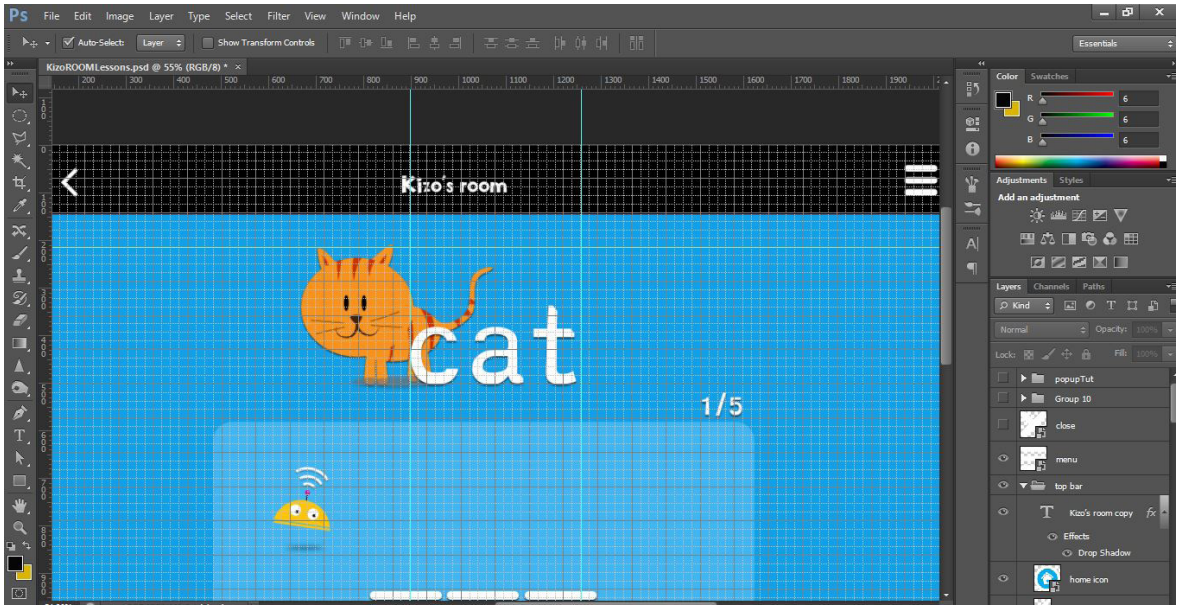
Wirframing and Visual Design

After establishing story and lesson planning, system architectur was brainstored. As observed in past prototyping sessions it was seen that chidlren immediatey want to explore an applcation or game and hence the structure should be intuitve and ready for immersion at the very start of the application.

These sketches were refined as more feedback was pulled from users.



Some intial mockup wireframes top left: activity to blend consonants and vowels | top middle : to resuce Robu from low battery kizo needs to spell Milk which has ending blend /lk/ | bottom left and right : similar blending activities | far right : learning through mapping key sounds as in this case l and k are together



Early UI DESIGN. Tool : Photoshop. I a followed a simple yet colorful initial screens create a play learn environment which is fun yet very productive.

Wireframing and Visual Design

Younger children, in the range of two to three years old, generally prefer bold, primary colors and high contrasts in graphic layouts that evoke exploration and discovery. I have tried to keep layouts as clean as possible and maintain an effective visual hierarchy.

I observed most kids want to explore and interact with apps quickly, but don't have a specific task in mind; therefore, design should be playful and exploratory, but uncluttered.

Kids navigate through an application almost exclusively by using icons andexpect their apps to be bright and engaging. Also it was observed during user studies that kids want feedback whenever anything happens. This would be addressed as the character Robu is already present for audio feedback.

VISUAL DESIGN

The design is welcoming and bright that welcomes user into the play and learn environment. Testa are kept a low as possible as children start interacting as soon as they get the device in hand. Handheld tab makes it great to learn in the company of an educator when she can guide the chidlren at first but the iteration is simple and will not take much tome to adjus to. Exercises are based on cards interface as as tasks are completed reward are gained. Charactes act as guide and make the application feel personl and thus trust is developned betweent the child and the application.


Notebook
READING
Learnt words : 4/20
bat
can
sat
cvc
SPELLING
Learnt words : 1
cat
cvc
Kids's room
CVC words
pat
sat
cat
SOUNDS
Consonants
p
b
c
s
t

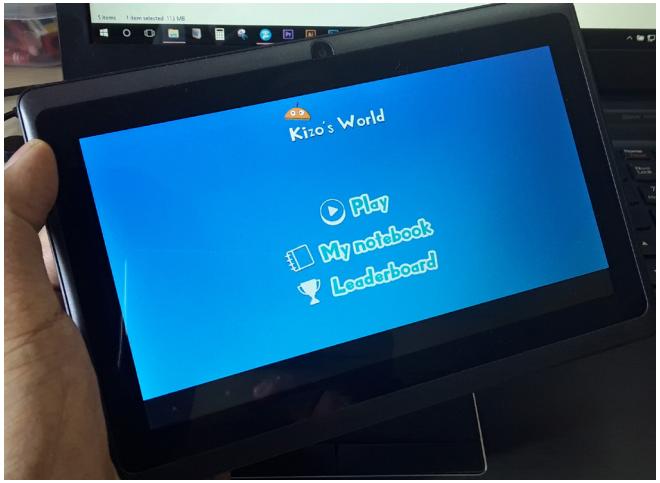
Final screens

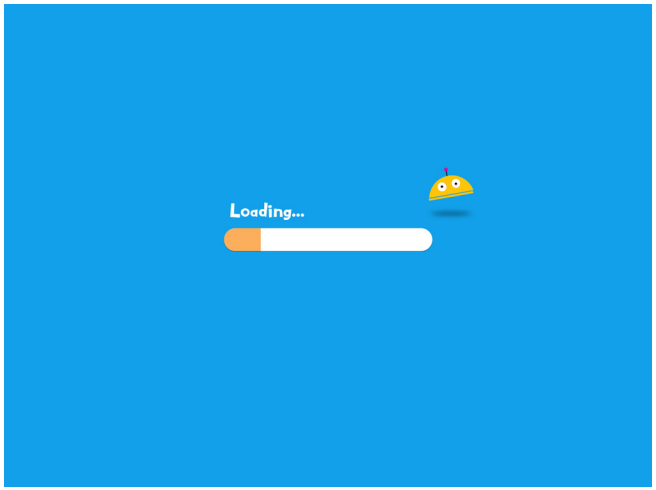
STORY > INTERACTION > CONCLUSION

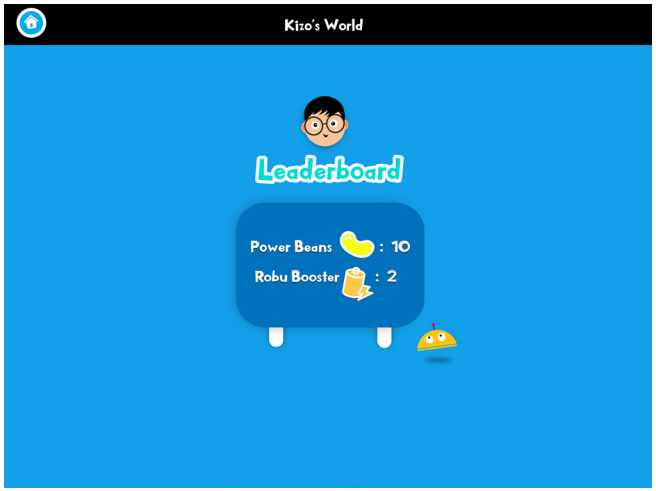
The application is designed for big screen handheld device such as a tablet. The colors are bright and the character Robu accompanies child from the very first screen initiating the close bond they will share during the course of this journey.

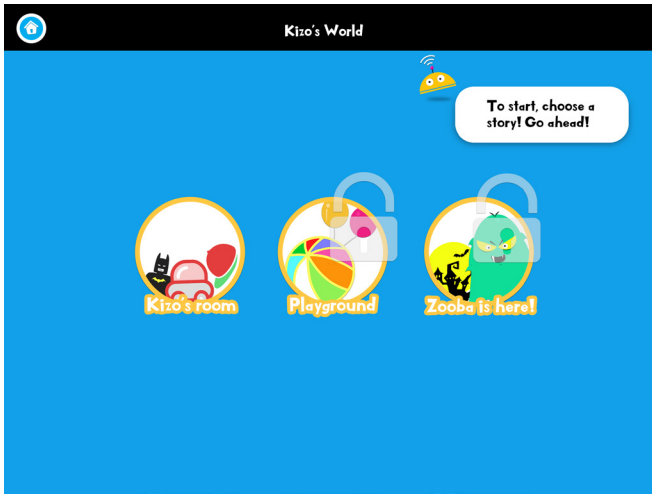
I have tried to keep as less text as possible until its very much needed for example in menus and the learning content.

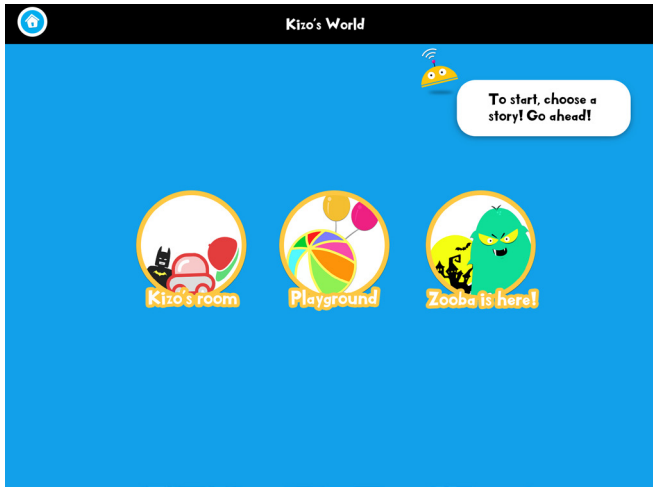
The leaderboad shows only the booster and beans collected by the two main characters. To start learning children have to select any of the environement, for the evaluation I have created three environment to conduct testing. The tasts inside these envronement will be tested with chidlren for feedback and subsequent interation and conclusion.

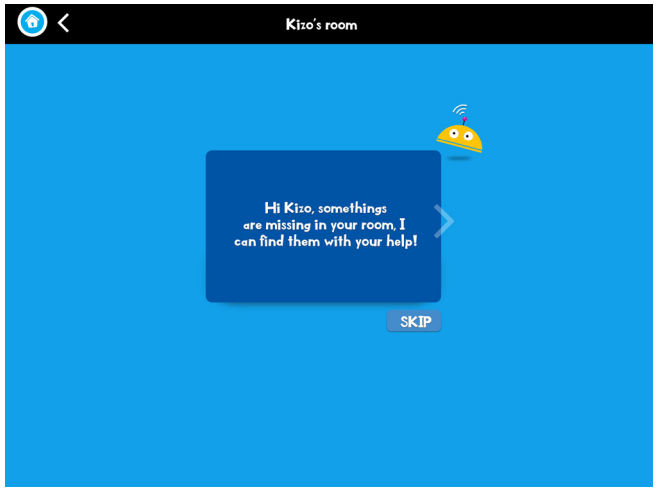


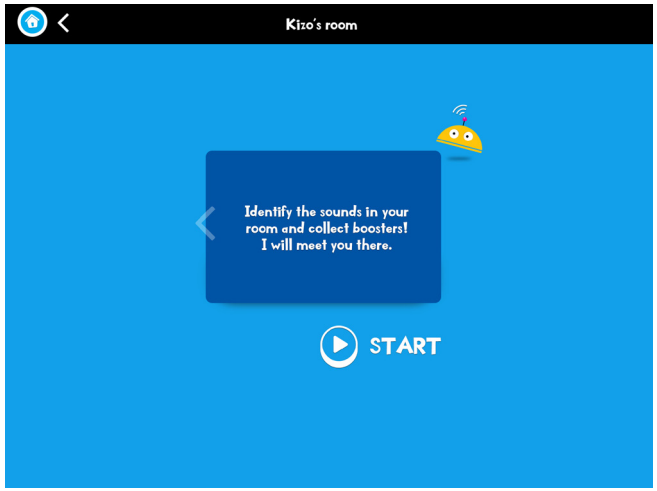


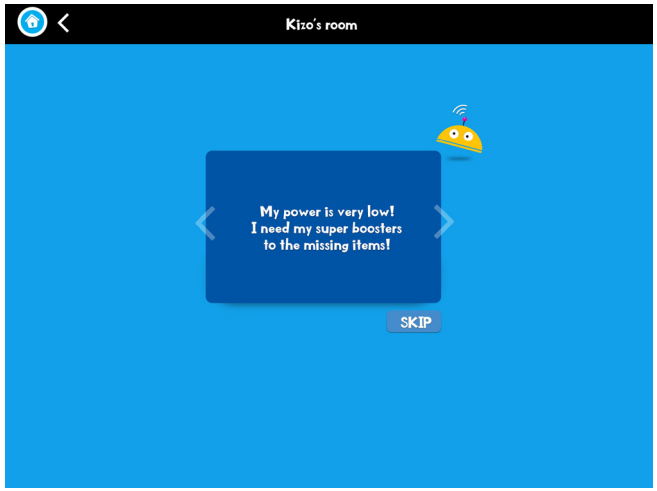












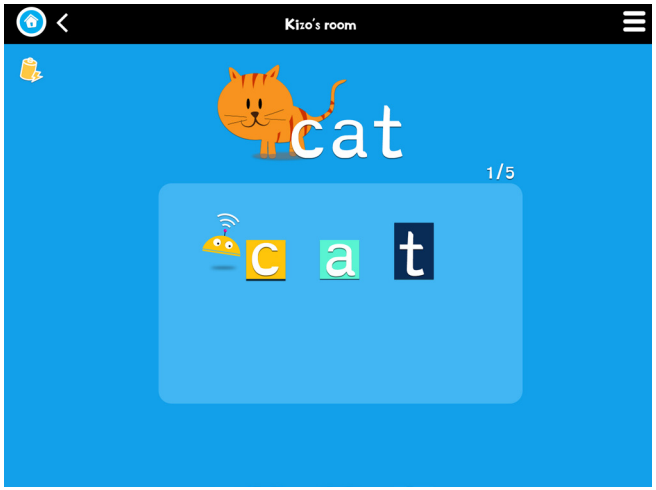
User selects an environment and Robu, the hovering robot takes kizo throught the overview of tasks inside ‘Kizo’s roon‘, the cards are shown along with audio feedback. Robus friedly takling keeps the child interested in what is written.

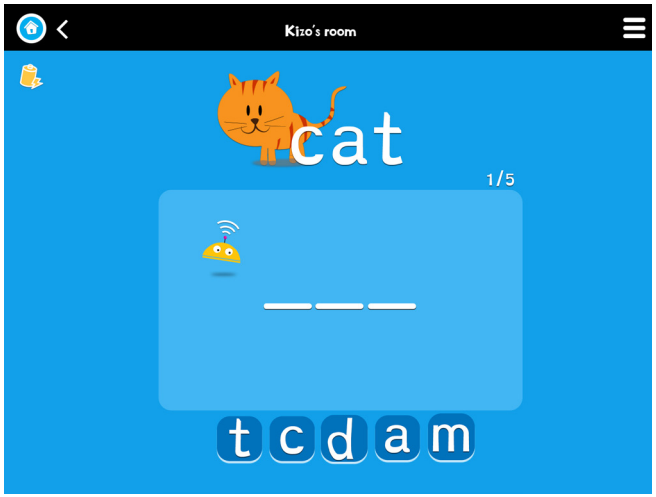
Tasks and lessons

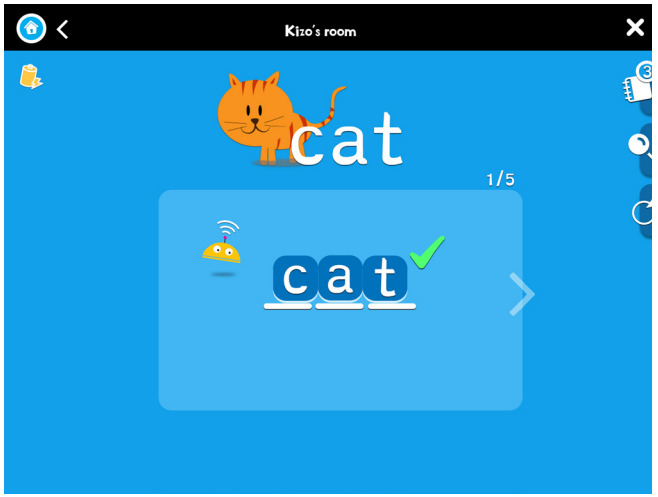
In these screens the lessons are initiated with five consonants and one vowel. It is crucial to not start teaching all consonants and alphabets at once but slowly and step by step.

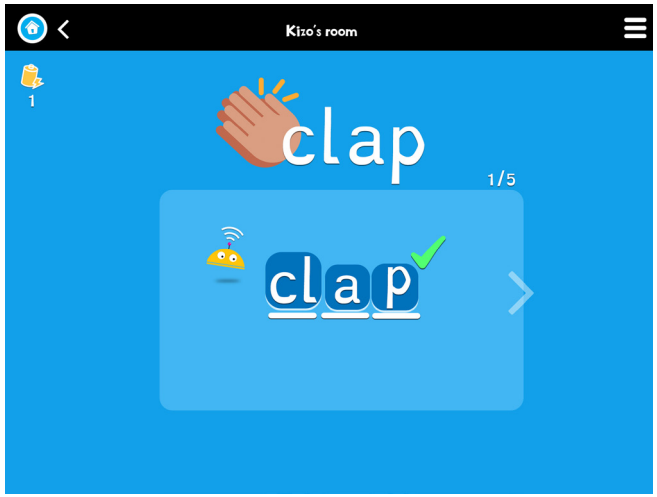
Here the activity is to learn letter sounds in simple CVC. consonant-vowel-consonant words. THe shape the word makes it also emphasised with orangce color to reinfornce memory of the word.

After showing the shape of the word and sounds of each letter and also together in the word, the letters drop to the bottom of the screen and the child has to select the correct letters to make up the word again. For this he drags the letters from botton and on tapping each an audio feedback is genrated that assits in forming the word again. On succcessful completion child moves on to the next word in the same family.









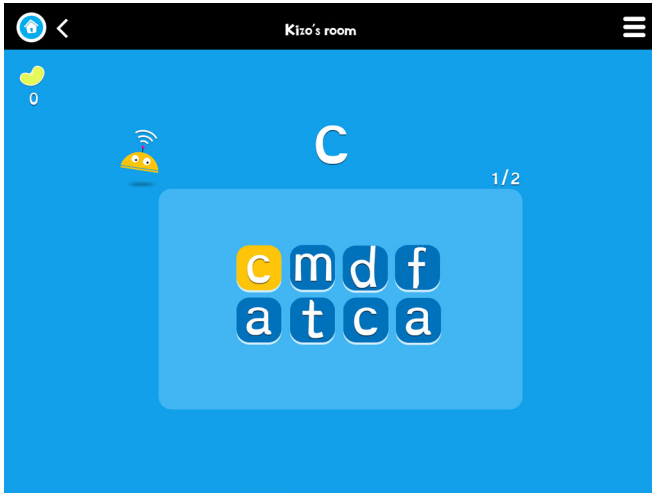
Blending activity with simple beginning blends such as /cl/, the clap sound makes the leanring more immersive and it helps in forming the word againa the bottom left figure.

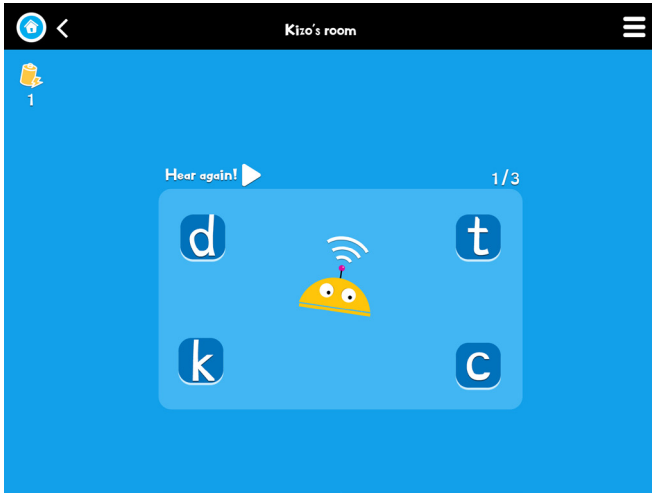
After the intial consonants and vowels are taught and revised the tasks move on to simple beginning blends which further becomes more complex as the lessons unfold with the story.

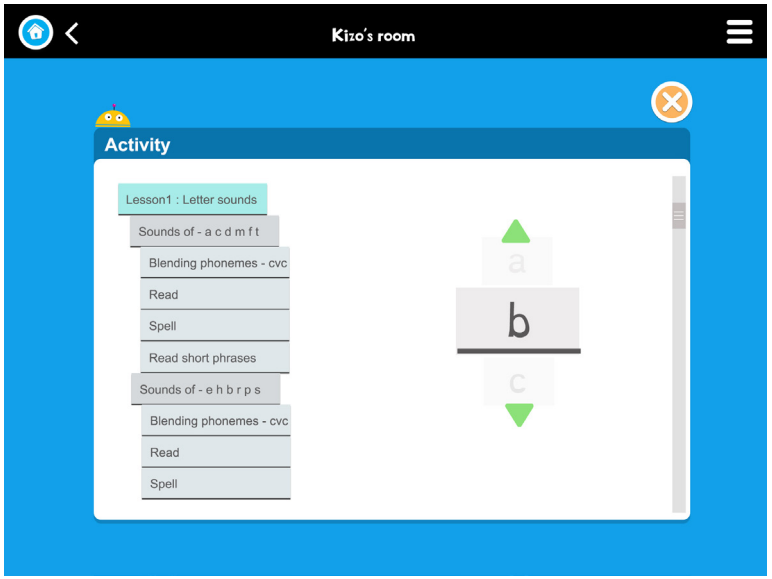
Revision and repetition

Each activity completion is followed by revision through context such as simple phrases with rhyming words as it was observed during user studies that introduction of similar sounds with different formation reinforces the meaning and ability to distinguish the sound.

In bottom right corner screen, MENU can be accessed by tapping the top right icon.

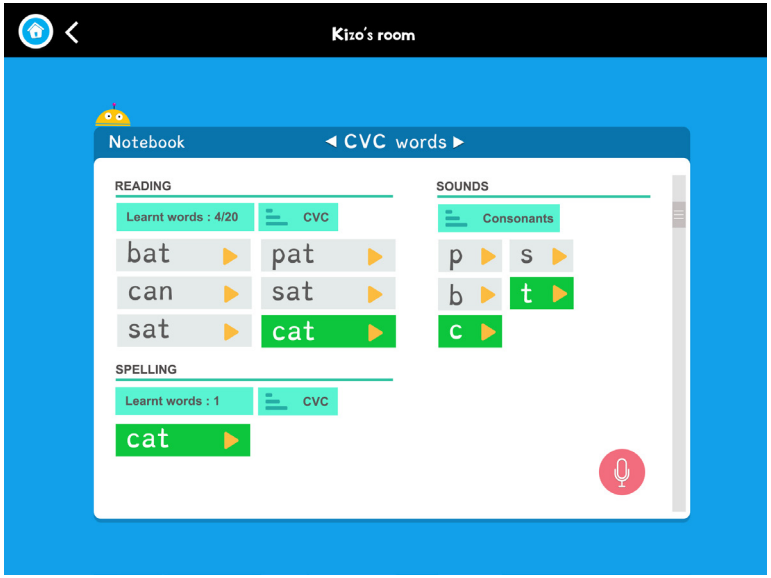


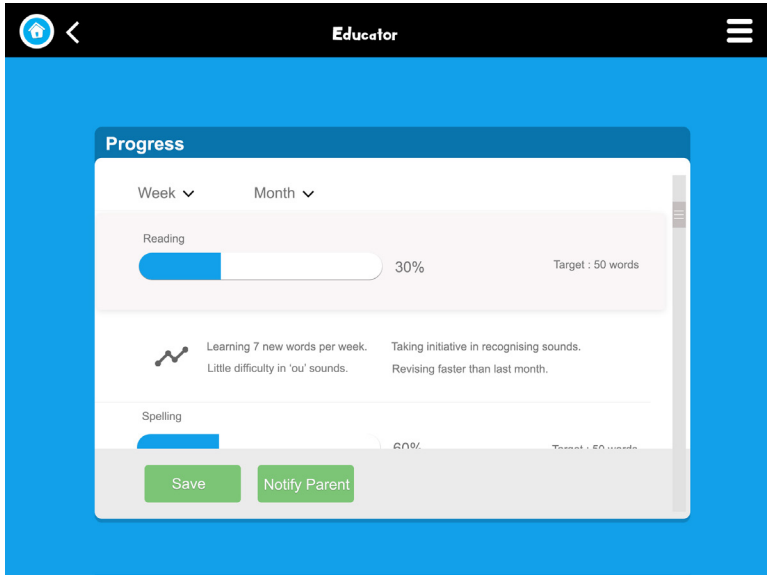




Notebook can be accessed any time during any task . The activity shows learnt words and revision prompts. The leant alphabets are displayed that cab be scrolled fast to tap and hear the sound again.

In the notebook the educator and parents can see how the child is learning and his/ her progress. For final evaluation I will be testing tasks the interaction in this screen as the main target for evaluation is to observe and document the use of the application and generate more insights.





Working Prototype

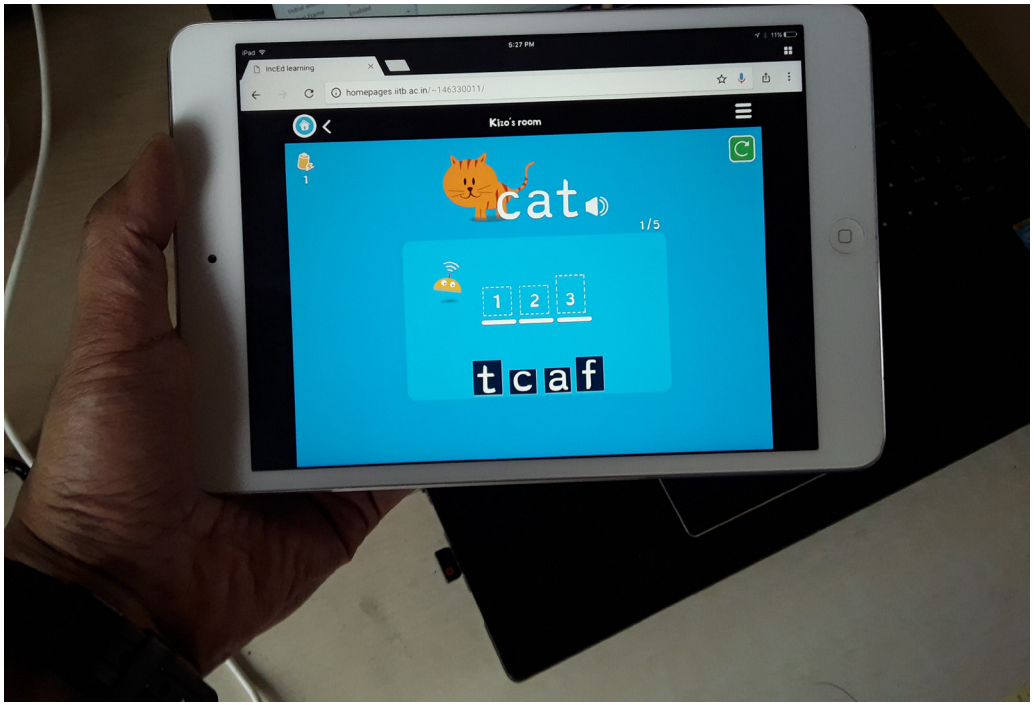
The prototype was based on sample tasks. This was a part of my application that focuses on assisting phonic lessons through practice and revision.

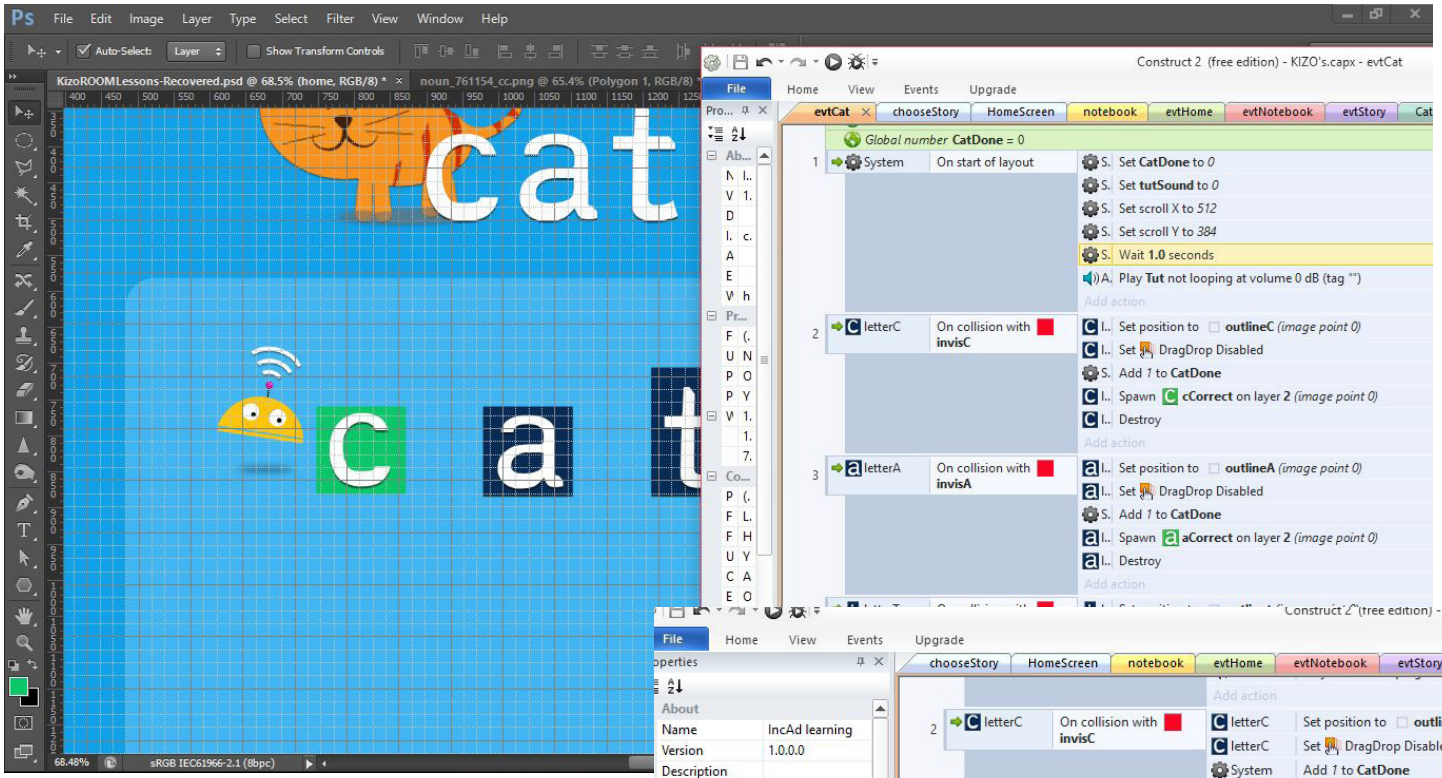
1. Task1 - Home- play and learn option - kizo's room - complete CAT phonics

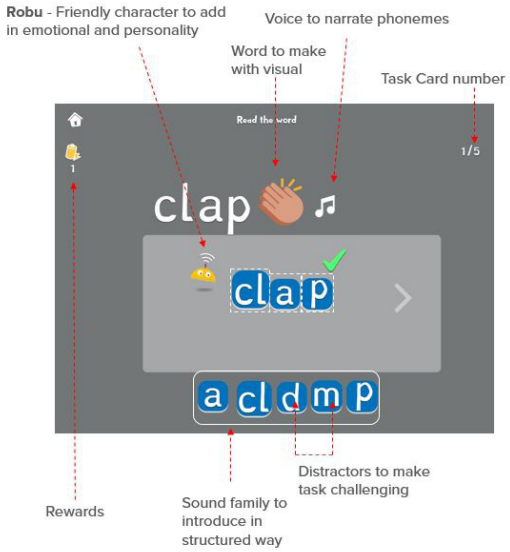
2. Task 2 - Home - notepad - listen to new word CAT, tap on play button to repeat what was learnt

3. Task 3 - Home - notepad - tap on camera - take photo and attach sound file to it (having technical glitch with requesting device camera).

Children can take photo of things around them, add a tag to them and save them in their notepad and attach there pronunciation as a tag. This helps in taking ownership and promoting independent learning. The feature gave some glitches on ipad as the native device restrictions are platform specific. However there is no error or issues in andriod or desktop version of the application.







WORK FLOW

I used HTML5, construct2 engine to create the tasks to set up the context and test the prototype with taget users. More exercises and tasks can be added to this framework as the basic structure is complete and working

Fig on botton right: a schematic of the main components in UI interface while high fidelity wireframing.

Evaluation

I started evaluating early in the project phase after user studies during ideation. I employed rapid prototyping to get quick feedbacks on my concepts from the users.

The first prototypes were made using paper and simple digital mockups on the targeted hand held device which was tablet in this case.

The feedbacks were incorporated with new design implications in to the final concept.

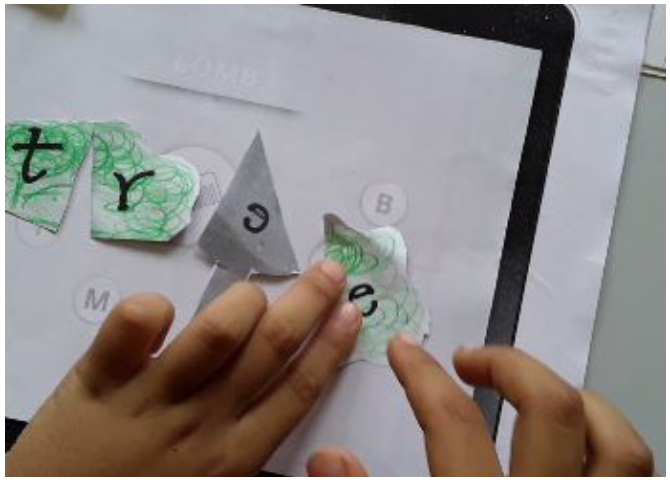
The final concept was detailed out and the prototype was built based on the scenarios to test with users under following settings:

1. Usage under a learning environment like in a learning centre.

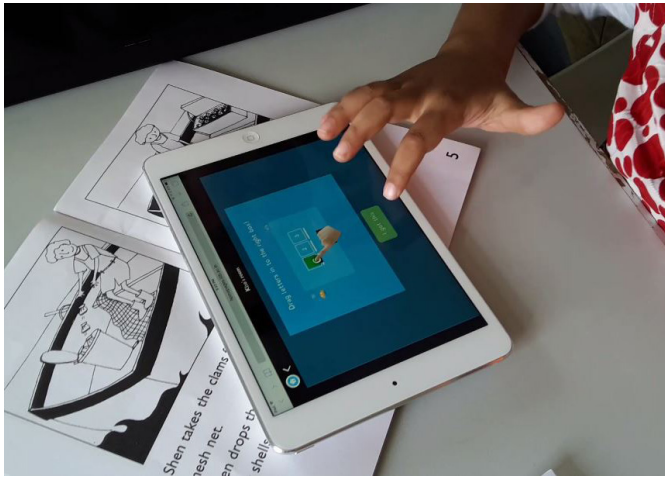
2. Usage at home.

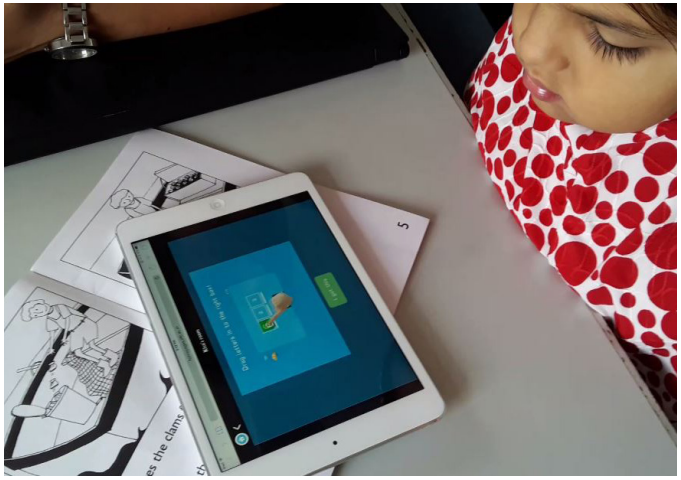
3. Usage at School.

On the basis of evaluation goals one setting was selected along with test protocols. The prototype



Early prototypes used for evaluation. These were rapidly prototyped and tested with users for quick validation of concepts and ideas.





Final prototype testing with children. Here you can see Sakeena aged 6 years ago using the prototype in a learning centre environment.

The evaluation was designed to figure out the both learning and usability issues along with the navigation design and audio feedback inside the application.

The application was tested with an I-Pad and both with and without headphones as the prototype relies on audio instructions. The prototype was uploaded to a website and the link was made available to the educators before the main testing day.

As I mentioned early evaluation started during the early rapid prototyping stage and by now I had fair idea to what to include for the tasks that were included in the working prototype.

The evaluation was divided into three stages -

1. Exposition pre test- the participants were briefed on the experiment. Once they are ready the prototype is presented and tasks were conveyed.

2. Test - Participant uses the prototype as per the tasks.

3. Discussion - Post test discussion with educators about remarks and possibilities.

Evaluation goals

To observe and understand the efficacy of a digital multi sensorial learning in a remedial education environment for dyslexic children.

Also to understand the issues that come up while using the learning aid such as usability, feasibility and conceptual issues.

The usage of the application during learning sessions was documented for later discussion.

Key questions

1) Are the kids able to make way through the application screens and complete learning tasks?

2)Are they able to absorb the concepts through the application in there remedial learning sessions with educators.

3) Is there anything else that is needed to aid for a better play and learn enviroment.

As I involved children with the ideation and early prototype testing I was able to direct my attention towards the pain points through detailed observation and subsequent iterations.

Evaluation Protocol

For the tasks in testing scenario, words that the user doesn't not know or have difficulty in grasping in the next session will be selected.

For this prior meeting will be help with educator to confirm the date and arrangement.

Observation will be on the basis of how quickly the concepts were grasped and retained.

After each task the kids will be asked to spell the words and sounds again without aid.

The accuracy and time taken will be observed.

The process will be documented through either video or audio recording as per the session.

Tasks

1. Participant completing a lesson sample - Students starts with daily revision and new words and saves what is learnt.

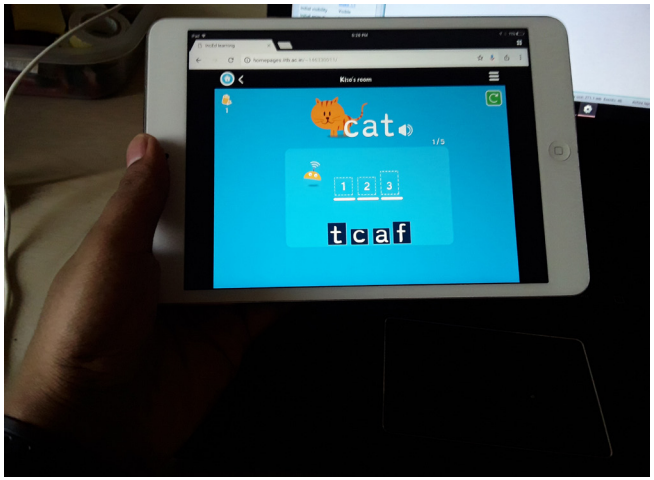
2. Participant completing a task and access diary to revise the word.

3. Going back to task and navigating to the next task.

4. Use audio instructions for navigation in the interface.

5. Write a word on notebook after using the learning aid.

I also tasted the prototype with regular children to get initial feedback on engagement and flow. Here I explain the application to the elder before giving it to the children.



6. Because of the children's ages, more emphasis was placed on the qualitative than the quantitative part by conducting interviews and observation. While children were playing computer games, unobtrusive observation was conducted by taking notes regarding their game preferences and interactions.

Qualitative questions:

1. How much he or she had enjoyed the learning application?

2. How much he or she liked school reading tasks that involved reading, ones at first and ones at the end of the test.

3. Average time taken in learning similar words.

Goals

Learning goals :

1. Know about how words are made up of individual sounds.

2.Understand the sequence of letters in word and their order.

3. Understand correct placement of tiles.

4. Recognise and identify similar looking letters and filter them out.

Usability goals :

1. Ease of navigation

2.Identification of icons and buttons with ease.

3. Audio cues for identifying what to do.

4. Ease of repeating the task.

5. Error prevention when incorrect choice is made.

6. Participants were asked to think aloud and verbalise their thoughts while doing the task, the educators were also asked for the same, as the child looks for cues from educator.

Initial UT with children age 5-7.
Tasks were carried out clearly. Children were not told what to do and behaviour and reactions were noted down.

There were few UI issues with icons as the children were confusing PLAY button with NEXT button on the NOTEBOOK screen.

More User testing at two centres is scheduled based on the evaluation plan till than refinement will continue.

	Task1		
	Card 1	Card 2	Card n
Understanding of tasks	✓	✓	
Understanding of audio cues	✓	✓	
Phonics/word retention	✓	✓	
Participant corrected errors	✓	No	
Responded to visual feedback	✓	✓	
Learning curve was short	✓	✓	
listened to audio instruction before starting the task	✓	No *User become used to the task flow after watching hearing the tutorial*	

Observations

After the session, the participants were asked questions based on observations from the tasks.

Questions were asked like, what did you find interesting in this learning experience? Why did you choose the other letter and not the first letter on a screen (Here I asked about why the user made some errors and what was the thought behind it).

In the same lines why did they choose what they chose. The educators were asked what they think can be different in the prototype.

Engagement

One of the motive of this learning aid was to retain user memory after learning happens and that was achieved through better engaging design. This was successful as the user wanted to perform more tasks on the device. Gamification ensure that user has incentive to go further and audio feedback after completion of each card ensured user hears again what they have achieved with the task.

In the first card, the kids were able to arrange the letter tiles in the correct sequence with the help of all the audio and visual feedbacks. But its not sure how they will interact with more complex grammar rules.

In sequencing the letters into the individual boxes kids were listened to the audio instructions and then dragged the letter tiles into the correct boxes to form the word. For a three letter words there was only one distraction provided in the form of a letter of similar shape or sound. This distractor helped them in visually and on based of sound identify the difference between the phonics and arrange them together to form correct words.

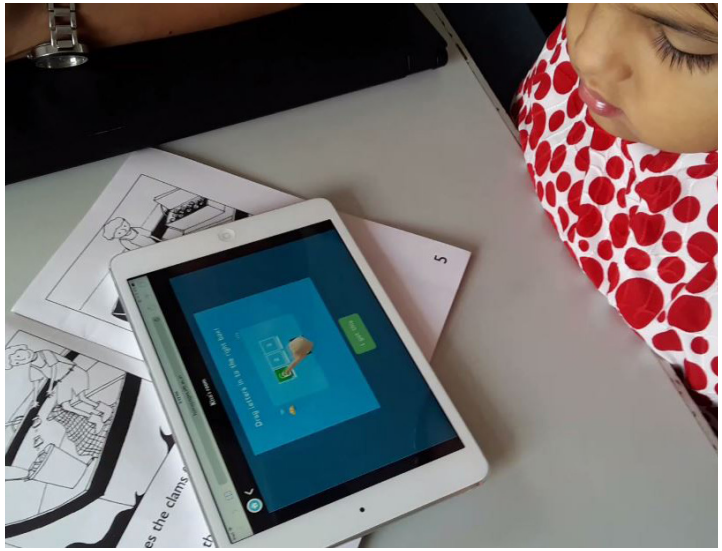
This in connection with more diverse grammar rules and further tasks as the child progresses will make the experience more richer.

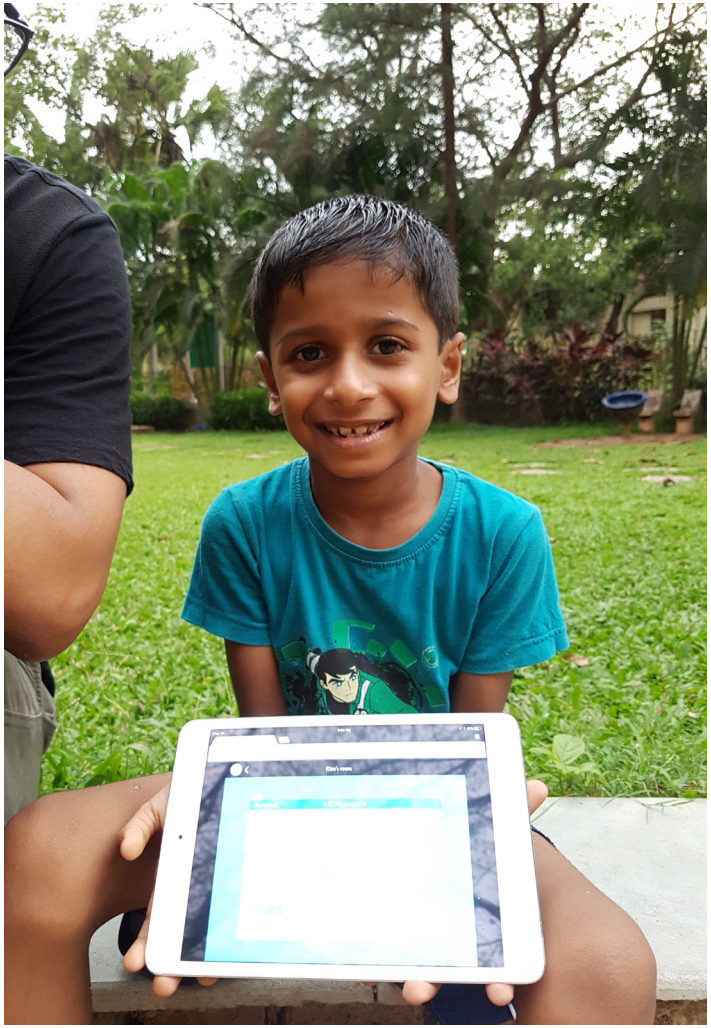
One drawback is that after sometime if there is no enough variation in the task the children might loose attention.

Educator's say on the game Educators were asked how effective will be the incorporation of this type of learning aid in their learning schedule. To this the reply was much optimistic in line with my early observation while ideating as its not about engaging children and making them repeat information again and again till they absorb the concept, but to help them learn efficiently in the way that suites to them in the best way.

With this prototype it opens avenues for incorporating a different way to approach remedial education sessions with helping the child revise content the way its helps them understand in the best way without distracting from the main lessons.

Teachers showed interest in the intuitiveness of the application and were on the same page in terms of how the application can be applicable on a large scale. They were also happy that the children can now learn on their own during revision sessions.





After the initial animated tutorial is watched by children it becomes easy to go through rest of the card deck in a task easy. To bring more challenge and incentive, more distractors such as similar sound letters,words were discussed upon.

User was able to understand sequencing faster when the simple rules of the task were established through visual and audio cues. It was the key thing in preparing a child and raising curiosity to start the tasks. This was an important insight as it tells about incorporating more relevant help at each step which after taking the child to the point when they feel accustomed to the rules make them learn and apply their learnings in better way in the application.

The interactive letter tiles were the key engaging content in the interface and more possibilities open in making them more customisable.

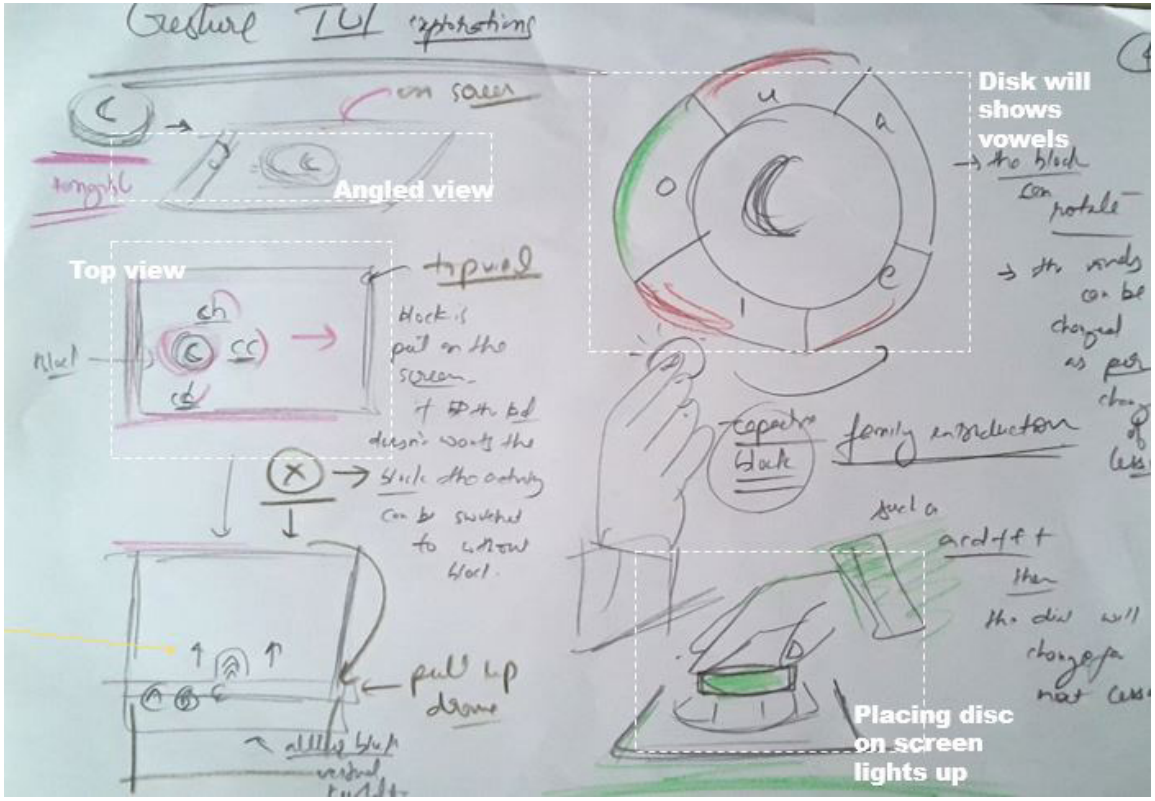
Further development This concept can be further developed in a bigger scale as mentioned in my ecosystem section by adding more tasks as the lessons are imparted.

With addition of customization of challenges in a task the tasks can be made more relevant to individual child as dyslexia is a spectrum reading difficulty and thus the intervention will be more efficient.

Distractions in each task and customisation ability to let educators add more relevant distraction to help children think and process more.

We can make tasks more challenging with awards integration with each success and increasing difficulty to have incentive and motivation between tasks.

Shortcomings The tasks had similar interaction styles without much variation except from the learning concept. This led some users assume or guess the sequence of letter in a word, this issue can be effectively handled with more customizable distractors in each task as mentioned in above section.



Tangible interfaces with digital UI can be uitilised for a more richer experience .

Future scope and conclusion

The man goal of this project has been to make life of a dyslexic easier and bring better approach through design intervention into imparting remedial education. If the application is efficient in bringing down the effort and time need to read and spell, it would be a great achievement.

For future scope I think of possibilities with tactile user interfaces that are not constrained by the interface or screen size. The letter combinations on the dials can be changed as the lession progresses and child gets more revision. Tangible mode can be disabled to start normal touch mode.

This project can be developed to be part of a full scaled application that can be installed in schools computes to assist teacher in helping children that are struggling. Evey new lesson can be feed into the application and the child learn it through tasks. To conclude, this project has been a great journey in understanding the importance of child learning, education and how design and technology can be an integral part of education environments.

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3 National Focus Group on Teaching of English - NCERT

4 wikipedia.org/wiki/Dyslexia

This project has been a life changing experience for me. It pushed me to do my best and made me realize how every child is unique, special and its our duty to ensure that each one of them, regardless of disability gets the opportunity to make their dreams come true.

By getting to research and know the world of dyslexics, I have learnt to persevere and keep trying.