



IDC School of Design
अभिकल्प विद्यालय

B.Des Design Project 1

Vocabulary Memorization Application for Hindi Medium School Students

Guided by:

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By:

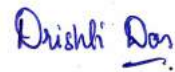
Drishti Das (18U130013)

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Approval Sheet

The B.Des Design Project - 1 titled 'Vocabulary memorization Application for Hindi Medium School Students' by Drishti Das, Roll Number 18U130013 is approved, in partial fulfillment of the Bachelor in Design Degree at the IDC School of Design, Indian Institute of Technology, Bombay.

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Abstract

The English language plays an important role in today's world. In most Hindi Medium Schools, English is taught as a second language from classes 5-7. The students are struggling with it given their lack of exposure, motivation, and current sociological conditions. The main aim of the curriculum is to enable students to communicate and understand the language effectively. In order for that to happen, the first step is to learn the script. The second important step is to master the necessary vocabulary words

This project aims at developing a solution that allows Hindi Medium school students from classes 5-7 whose primary language is not English to learn and memorize a certain number of new words over a set period. This report covers the secondary research on existing learning and teaching methods and alternatives currently in use and primary research conducted on the Target users and the English subject, the results of the research, analysis, and a suggested solution.

Introduction

Everyday learning fundamentally has multiple stages, one of the major ones being memorizing and recalling. While memorizing happens during the studying process, recalling happens at the end, usually before an exam or a certain important class. Since those two are co-related I'd like to create an interface or an application that caters to both. With school students being subjected to learning so many subjects at once, each with a specialized approach to learning, a lot of information has to be consumed. Certain areas even prioritize memorizing over understanding in their syllabi. An application like this could come in handy in such situations. I am aware of how this approach alone would change based on the subject, and within that, the content and the target user group.

During the later part of the initial study, the focus was narrowed down to English as a secondary language in regional Indian schools and how the language plays an important role in today's world. This project mainly focuses on presenting the English vocabulary to school students in a digestible form so that it provides a base for quick learning of the language over time.

Background

Narrowing Down

While deciding on a topic, focus was laid on the learning aspect for younger students. At this level, feedback suggested that the title be more specific which led to me fiddling with multiple aspects which boiled down to creating a memorizing and recalling application for school students.

Initially, the crust-level research suggested that school students are overloaded with subjects with a lot of depth, requiring them to study from multiple sources at a time. As this is a common scenario in most Indian Schools, it made sense to have a product that would help them memorize and recall.

Three possible directions were considered to tackle this problem viz, a bottom-up and a top-down approach that are curriculum-related and some non-curriculum but still important areas. Following that, a bottom-up approach was prioritized, which basically involved focusing on a specific subject or an area under that. Multiple papers with similar topics and areas people had already worked on were also referred for the same.

Understanding Psychology by Feldman was also referred to understand some basic terms like the Cognitive approaches in memorization and psychological processes that occur within that.

Focus on The English Language

A lot of initial research had pointed out that within language learning, vocabulary is something that people pick up with schooling and exposure equally combined. For this project, the English vocabulary was chosen as the primary focus as it plays an important role in today's world. It is one of the Global languages present in all professional and administrative systems, often opens additional employment opportunities for those good at it, and is the first and most preferred language for many well-educated Indians. Hence, naturally, being proficient in English is important in the current age.

This project required understanding the English language, its importance, how it has been taught so far and the issues with the way it's taught.

It was found that, while in most schools English is taught from the primary level itself, a lot of non-English medium schools have English as their second language, usually introduced in class 5. The main reason for incorporating it in their curriculum is to enable students to be able to communicate and understand English on a daily basis.

The aims and objectives of teaching English as a second language in non-English medium schools have four major aspects : Listening, Reading, Speaking, and Writing and under each of them, there are certain specifications to prove that the subject is being taught well.

Understanding the User Group

The user group i.e. the students, there are mainly two kinds: students with regional language as a medium of study from the primary level and students with English in their primary level. The ones at the former are most likely from rural backgrounds. They are the ones who are likely to have English as their second language, and they face a lot of downsides while learning English. There is a lack of exposure, motivation, and their sociological conditions influencing their education, like, low income, poor infrastructure of government schools and so on.

With that, the **what and who** of the design brief were specified, along with the **Target User Group**.

It is to design a **Vocabulary Memorising Application for Class 5-7 students with English as their second language and are struggling to cope with it.**

Secondary Research

Based on the initial study, some inferences were derived.

Since there is no immediate need to learn and use the language, most students are facing the repercussions once they get older (get exposed to the outside world).

The current learning methods seem to be a lot of conscious effort and tiring procedures, just like schoolwork.

It is restricted to the class environment. It is missing out on real-life application in our day-to-day lives, (which is a less self-conscious method of learning). It would be ideal to create a motivation for students to learn in the present, even use multimedia strategies while keeping their sociological factors in mind.

Learning Models

During secondary research, in an attempt to get a zist of Instruction Design, I was introduced to multiple learning models and learning methods in the Instructional Design Course by Prof. Venkatesh from IDC.

I dabbled through Blooms Taxonomy, Merrill's Component Display, Piaget's Theory: Cognitive Development of a Child, Vygotsky's Theory of Proximal Development, Behaviourism, Constructivism, Assimilation & Accommodation. Most of them were helpful and were mentioned in the report.

Competitive Analysis

To narrow down further, clearly specifying the aspects of the problem area, focus was fixed on Hindi medium school students, ideally from class 6 and above, assuming that they are already familiar with the Roman script and are currently improving their vocabulary. For this purpose, existing applications like Duolingo, Linguix, and “Word Power Made Easy” by Norman Lewis, etc were analyzed thoroughly.

Duolingo

“A language-learning interface that doubles as a digital language proficiency assessment exam.” Duolingo does have an English learning option but only from Hindi, which leads to changing the entire interface to that language. For a first-time learner, they introduce you to some simple words with illustrations and enunciations. It has a simple, engaging UI. For those already familiar with English, there is a small test to check your English proficiency. It also has an Illustrations of Indian People in the background, encouraging the users.

One of the major observations included the fact that it is familiarizing its target audience using the visuals. The answering of questions and the learning process is very simplified. There is a repetition of words, mostly after a mistake. It has a gamified experience of points and levels to increase engagement. However, the instruction is basically a translation of the usual, the process taken up for this doesn't seem different from the other languages.

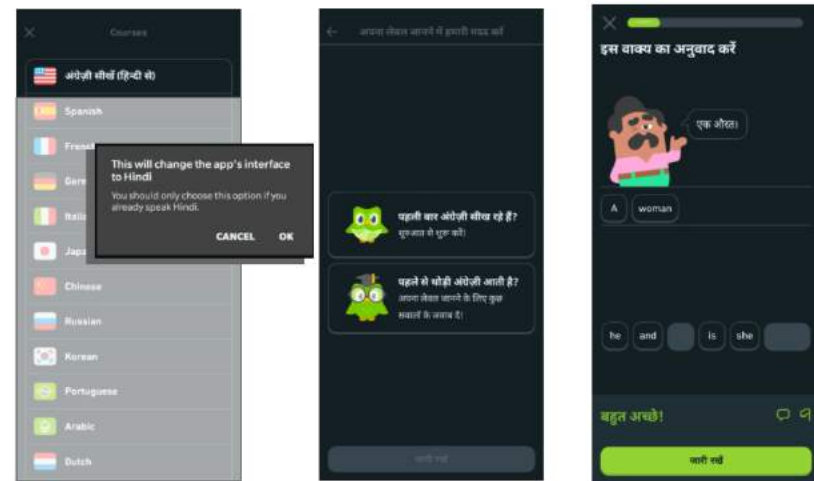


Figure: Duolingo App Interface

Linguix: Chrome Extension

AI-Based Writing Assistant was the second application that was reviewed. It is a Chrome extension called Linguix, and it particularly has a feature called definition suggestions. In this case, when logged in as a non-native English speaker whenever a web page is opened, there are certain words that are highlighted in purple, which do seem like simple words. Clicking on the word shows all possible definitions, multiple uses, thesaurus. Clicking further, it opens to a web page with more info about the word and mainly, a word frequency detector. In this case, “browse” is in the top 1000 words.

It was observed that it doesn't require active participation and is a seamless intervention to learning necessary words. They have only highlighted the frequently used ones and the learning is through definitions and examples, similar to a dictionary.

Although it is a bit ironic considering if a user is a non-native speaker and not proficient in the highlighted words, there is a good chance that they won't understand most of the content they are reading as it consists of comparatively complex words.

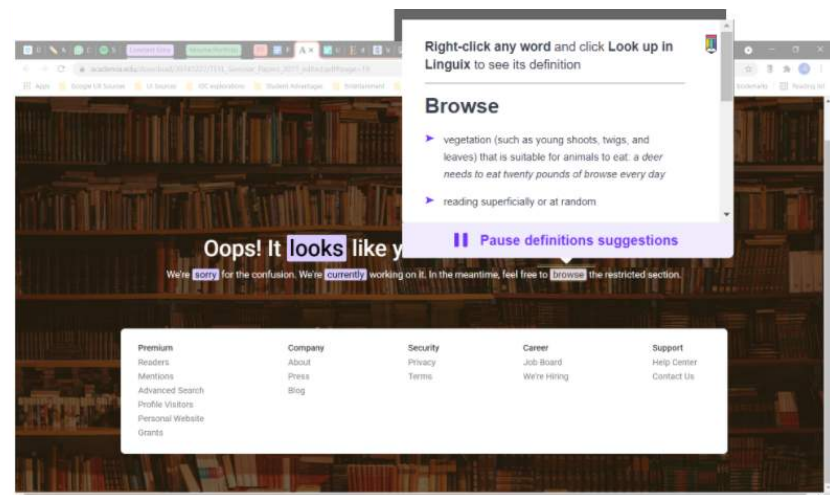
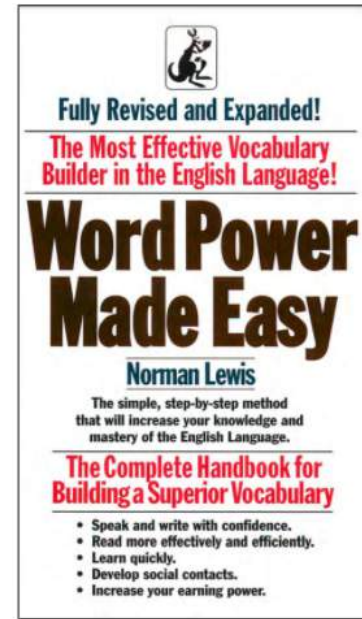


Figure: Interface of Linguix Chrome Extension

Word Power Made Easy

“Word Power Made Easy” by Norman Lewis, an extensive repertoire of mental workouts to develop the subtle nuance of English grammar. This is an intermediate-level vocabulary workbook. It includes a test in the beginning to know your present level of knowledge on multiple aspects, explains areas like etymology, and has a motivational speech about how anyone can learn anytime. It was observed that the book is extremely text-based, but the language is very engaging. It has a thorough vocabulary syllabus and seems ideal for someone like me or with my level of proficiency. Another downside is since it very much resembles a regular school book, The user might lose interest. Overall, this will ideally be used as a reference.



CONTENTS	
How to Use This Book for Maximum Benefit	ix
Why this is not a book to be read; how to learn to pronounce the new words correctly; how the etymological approach works better than any other method for learning words quickly and permanently; how to master nouns, verbs, adjectives, and adverbs in five to ten minutes; how to use the psychological principles of learning to sharpen your verbal skills.	
PART ONE GETTING OFF TO A GOOD START	
1. How to Test Your Present Vocabulary	3
How vocabulary growth of the average adult compares with that of children; a simple test to show you whether your vocabulary is below average, average, above average, excellent, or superior in range, verbal speed, and responsiveness; important evidence of the close relationship between vocabulary and success.	
	vii
2. How to Start Building Your Vocabulary	19
How building your vocabulary will enrich your thinking, increase your self-assurance in speaking and writing, and give you a better understanding of the world and of yourself; why it is necessary to recapture	

Figure: PDF of the book “Word Poer Made Easy” by Norman Lewis

Specifying the Content

Now getting to specifying the content. i.e. the purpose of vocabulary instruction and word selection.

In vocabulary instruction, the meaning of the word shouldn't just be restricted to the dictionary definition but more of an explanation. Emphasizing the connection between words, Promoting usage of words in different situations, and finally, having a review /recall from time to time to refresh what is learned.

There are two kinds of vocabulary instruction: **Direct and Indirect**. In order to make direct vocab instruction fun and engaging, illustration examples, anecdotes, auditory and visual interactions could be introduced. The students could also develop their own connections, explanations, illustrations etc. For indirect vocab instruction, the main point is exposure, so, hearing and seeing words repeatedly in different contexts, while reading, conversation, browsing, video etc., could be used.

For this particular project, I've decided to create an application based on Direct Vocabulary Instruction, as it is crucial for students to actively learn the language, irrespective of being in the classroom environment.

Memorization in Psychology

A quick study on long-term vs short-term memory showed how often the information consumed has to be reminded over time in order for it to settle permanently in long-term memory and can be easily retrieved, which is what the **forgetting curve** delivers.

The following are the three main stages of memorizing and retrieval :

1. short-term memory (15-30 secs, 5-9 items of info)
2. long term (few mins - lifetime, repeat interactions)
3. Retrieval (recall & recognition, often like cues)

Primary Research

The primary research in this project involves understanding how Hindi medium school students learn English as their second language, their experiences, the problems they face and how they overcome them, their limitations and other platforms of learning (if any) to design an English vocabulary memorizing application. An Ethics (IRB) Proposal was drafted for the study.

It involved two groups of participants:

Group A- Class 5th-6th students (aged 9-12) in Hindi medium schools with English as their second language. They are already familiar with the Roman script, and are currently improving their vocabulary.

Group B- Hindi Medium Teachers who teach English as a second language.

The plan to for the interviews:

1. Talking to Group B i.e. teachers, to familiarize with the target user's situation and background. This group will have an understanding of the language, it's teaching techniques and strategies, and the issues they face.
2. Talking to Group A i.e. the students, is to understand the problems they face, exposure to the language and the extent of English learnt as a second language. While keeping in mind I would be conversing with children below 18 years and in the presence of a parental/guardian figure.

The Interview Process

Initial recruitment for interviews were from acquaintances and word-of-mouth and the interviews were conducted remotely, mostly via phone calls.

From all over India, 15 teachers who teach in classes 5, 6th were interviewed using semi-structured contextual inquiry. Did not restrict the interviewees to be just from Hindi Medium Schools.

Even though all the teachers taught English, some of them were not specifically English teachers. Information was also sought from some English tuition masters and CBSE/ICSE (English medium) teachers to differentiate between their teaching patterns.

This was the structure followed when conducting interviews.

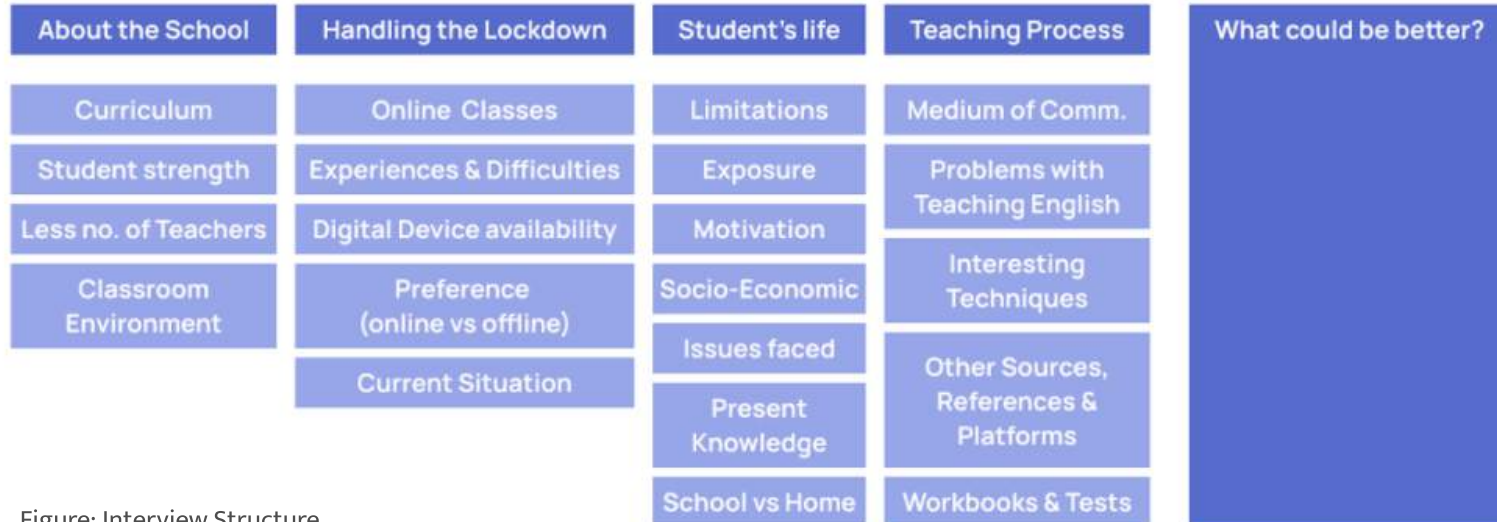


Figure: Interview Structure

Analysis

Affect of Sociological Conditions

Most Hindi medium schools are present in isolated villages with neglected staff or teachers when compared to the large number of students. Students who attend these schools are usually from a financially insufficient background where the parent's aim is to at least have them pass 10th grade.

Current Lifestyle

Once home, the students only commute in their mother tongue, making the school the only place where English is actually used. Approx. 70-80% of students have access to a digital device may it be a phone or TV and if not, measures were taken to adjust, like going to a friends house or the teacher going to an isolated area with a low signal to teach.

Online Medium

Most teachers preferred offline classes for direct instruction based teaching as they found it hard to adjust during the lockdown and the classroom environments are more lively.

Motivation

A lot of students are scared but at the same time excited to learn a new language. There are always a certain number of students with high motivation who excel in class, but most don't see any point in learning.

Specified Target Audience

Based on these insights, the target audience was further specified. The user's household would at least own one digital device, in most cases, a smartphone and they could have access to it after returning from school/work, let's say in the evening. It would be a part of the leisure time and would be unrelated to school syllabi and igniting motivation would be an effect instead of cause as students with particularly high motivation and dreams would actually end up in a situation where English proficiency is a necessity. But a student with 'not so high' aim might get motivated to learn English through this application. Hence, the application has to be simple and engaging.

Restated Design Brief

English is taught as a second language from classes 5-7 in most Hindi Medium Schools and students are struggling with it given their lack of exposure, motivation, and current sociological conditions. English is an important language in today's world, and if not learned well in the early stages, people face the repercussions and realize its importance much later. While the first step is to learn the script, the second important step is to master the necessary vocabulary words.

Hence, the brief is:

Design a Vocabulary memorizing application for Hindi Medium School Students from Classes 5-7 with English as a Second Language (focus on class 6).

Content Analysis

The vocabulary was carefully chosen based on the following factors:

Frequency of Usage

Some common words appear more frequently than the rest. The top 3000 most frequently used English words were considered for the content. It's important to form a good vocabulary base for learning English in the future.

Potential Sources of Exposure

Looked for English words mentioned in Hindi news channels; Conversations with friends, family, and other local people; Online media, articles, and videos; Newspapers, Vocabulary-enhancing books, and their Curriculum-based English textbooks.

Word Class (Parts of Speech)

The part of speech indicates how the word functions in meaning as well as grammatically within the sentence. They are normally recognized as four major word classes (verb, noun, adjective, adverb) and five other word classes (determiners, preposition, pronoun, conjunction, interjection), making nine-word classes (or parts of speech) in total.

Word Formation

Word-formation refers to how new and more complex words are formed on the basis of other words or morphemes. There are four main kinds of word formation: prefixes, suffixes, conversion, and compounds.

	Nouns			Verbs			Adjectives	Prepositions	Others
1	time	information	question	be	need	set	good	to	the
2	person	business	game	have	include	love	new	of	and
3	year	service	course	do	help	require	first	in	a
4	way	site	country	say	provide	receive	last	for	that
5	day	system	idea	get	start	lead	long	on	I
6	thing	student	event	make	create	develop	great	with	it
7	man	program	process	go	become	change	little	at	not
8	world	lot	name	know	keep	continue	own	by	he
9	life	something	use	take	write	play	other	from	as
10	hand	family	result	see	read	begin	old	up	you
11	part	page	example	come	follow	consider	right	about	this
12	child	home	money	think	learn	hold	big	into	but
13	eye	book	datum	look	show	support	high	over	his
14	woman	product	change	want	add	move	different	after	they
15	place	school	today	give	put	believe	small		her
16	work	community	research	use	offer	base	large		she
17	week	area	job	find	mean	happen	next		or
18	case	member	New	tell	allow	understand	early		an
19	point	website	customer	ask	like	buy	young		will
20	government	experience	post	work	run	grow	important		my
21	company	issue	team	seem	pay	turn	few		one
22	number	project	right	feel	bring	meet	public		all
23	group	state	level	try	build	increase	bad		would
24	problem	user	friend	leave	live	share	same		there
25	fact	month	blog	call	lot	spend	able		their

Figure: Top Most frequently used words

These were divided into three major categories:

1. Words you already know,
2. Words you need to know,
3. Words great to know.

This aligns with,

Vygotsky's theory: Zone of Proximal Development.

“Our learning space is mainly divided into three parts:

Tasks the learner can do independently, tasks they can do with guidance, and tasks they cannot do even with guidance.”

The Zone of Proximal Development is defined as the space between what a learner can do without assistance and what a learner can do with guidance. The point is to always aim for that zone when introducing any new material.

In this case, the more your vocabulary knowledge increases, the proximal development zone expands further.



Figure: Proximal Development Zone

Word Class

The words under the given categories have individual meanings, synonyms and antonyms. Hence, we'll be focusing on these for our content.

The four major word classes (parts of speech) constitute:

1. Verb
2. Noun
3. Adjective
4. Adverb

A **noun** is a word for a person, place, thing, or idea.

Nouns can be singular or plural, concrete or abstract.

Nouns can function in different roles within a sentence i.e. subject or object.

Mother

Building

Cloth

An **adjective** modifies or describes a noun or pronoun. It usually answers the question of which one, what kind, or how many.

Kind

Expensive

Dirty

The **verb** expresses action or being. There is a main verb and sometimes one or more helping verbs. A verb can be both singular or plural based on the subject and can take different forms to express tense.

Run

Work

Study

main verb

An **adverb** modifies or describes a verb, an adjective, or another adverb but not a noun.

Quickly

Carefully

Very

Well

adjective + noun

Kind Mother
adj. noun

Expensive Building
adj. noun

Dirty Cloth
adj. noun

adverb + verb

Run Quickly
verb adv.

Very Kind
adv. adj.

Work Carefully
verb adv.

Study Very Well
verb adv. adv.

Figure: Examples for adjective, noun, adverb and verb

Others

(preposition/ pronoun/ conjunction/ interjection)

These word classes are quite basic and familiar to the target user group as we're focusing on 6th standard students (year 2) of secondary English education. While the content might not seem relevant for the application, it would be used during explanation and communication throughout the interface.

Word Formation

The expansion or formation of a complex word begins with the base word. The four main kinds of word-formation are:

1. Prefix,
2. Suffix
3. Conversion
4. Compound

Prefixes are letters that we add to the beginning of a word to make a new word with a different meaning.

Examples: multi(many)- multipurpose; un(not)- unusual

Suffixes are added after the base or stem of a word. The main purpose of a suffix is to show what class of word it is. Often, the suffix also causes a spelling change to the original word. Eg: Actor; Forgetful

Conversion involves the change of a word from a word class to another.

For example, Can you text her? (verb from noun text)

They are always jetting somewhere. (verb from noun jet)

In **Compound** words, we link together two or more bases to create a new word. Normally, the first item identifies a key feature of the second word.

Eg: Back + Ache = Backache (Ache at the Back)

Ideation

Based on **Piaget's Theory of Cognitive Development**, our target users fall into the age group of seven to eleven years old i.e. the concrete operational stage.

In this stage, children start logical and adult-like thinking. They are able to apply logical reasoning and rational thinking in several areas of knowledge at the same time, yet limited to familiar objects and events. Thus, children around this age group are proposed to practice language classifying objects and ideas and using analogies to show the relationship of their knowledge.

Here are the prominent characteristics and thinking patterns at this stage:

1. **Classification:** Sorting things into categories, understanding there are also sub-classes within groups.
2. **Conservation:** understanding something can stay the same amount even though it looks different.

3. **Decentration:** similar to conservation, concentrating and manipulating several factors at the same time.
4. **Reversibility:** understanding that actions can be reversed.
5. **Seriation:** mentally sorting a group of things into some sort of order.
6. **Sociocentricity:** no more egocentric, can consider and think from others point of view.

This provided direction for ideation. Ideas and strategies were further developed based on these specific tactics.

Word Association

The term association refers to “the connection or relation between words, ideas, and concepts, which exists in the human mind.”

While the noun phrase “word association” itself, means "stimulation of an associative pattern by a word" or "the connection and production of other words in response to a given word.”

It is either done spontaneously as a game or a creative technique to improve vocabulary and familiarize with new words while providing context for the related words.

This in-person game involves multiple players. Once a random word has been chosen, the next player will find a word associated with it, quickly and so on. It also requires a viable explanation for the connection between the words, if not obvious.

This kind of activity i.e. exchange of words triggers logical thinking and involves skills like reasoning, organization, and categorization, while also actively expanding their vocabulary and creating connections. This approach is ideal for our target age group (students in classes 5-7).

Word associations are usually meaning-based i.e. synonyms (same meaning), antonyms (opposite meaning), and context-related words. It could extend further than that, for example, word structures using word formation principles. Even words prone to confusion like homonyms, homographs, and homophones could be included.

The opportunities for word associations are endless as it offers challenges and creative freedom to the users by forming connections that make sense.

Learning Objectives

Following the ABCD: Audience, Behaviour, Condition, Degree method of setting Learning objectives, the initial goal for the application was formulated.

Given the most frequently used 3000 English Vocabulary words (condition), a 6th standard Hindi Medium student with English as a Second Language (audience) will be able to memorize and recall (behavior) 35-50 words in one week time (degree).

The primary action associated with the user group is reading and listening (understanding) because of the media and books they're currently exposed to, rather than speaking and writing which is used only in their classroom environment.

It is a little advanced given their background and Hindi-speaking nature.

Hence, the design must

1. enable users to comprehend the meaning of a word when emphasizing on the provided context (especially when reading).
2. Equip users with expandable vocabulary that could be used as a strong base for further English learning.
3. Aid with gradual memorization and recall of the newly learned vocabulary.
4. Have a simple but engaging interface to ignite motivation as an effect.

Final Design Concept

Based on the research and study conducted regarding the English language and the target user group, design goals were specified and different ideas/directions were explored and developed throughout ideation, which was then combined into one tool, the users could use in fulfilling their learning objective.

Using the word association principles, the application is designed to aid with introducing and memorizing new vocabulary words and conveying their contextual meaning with fun word-learning exercises.

There are levels to this application. Each level is divided into three phases the user must go through:

1. Base word
2. Association words,
3. Test

Hence, the outcome of using the application is, the user will be able to read quickly and easily, as well as comprehend the meaning of the words they are reading.

This also provides a great exercise to induce and deduce the meaning of unfamiliar words from the context itself, rather than referring to the dictionary or google for the meaning each time.

Base words

the first phase is where we introduce the base words from which further associated words can be generated.

The base words would follow the format of **adverb-verb** and **adjective-noun**. The words would be simple and come under the umbrella of the user's existing vocabulary.

Association words

the second phase is divided into two parts: **meaning-based** and **word formation**, for now.

It can be expanded further to include homonyms, phonetics, phrases, and so on and each of them would have a different approach. For the project, I've focused on the two.

1. **Meaning-based:** This includes synonyms, antonyms, and analogies of the base words. Since these exercises are relatively easier and familiar, they will be introduced in the first level. There are 4 variations of these exercises and are consistent throughout the application while the complexity of the words increases.

2. **Word-formation:** This includes prefixes, suffixes, conversions and compounds. This exercise is a bit more complex compared to the previous due to the introduction of complex words and potential confusion. Hence, they will be introduced at second and third levels, once the user has been familiar with the application. There is one exercise based on each word-formation, so a total of 4 variations.

Meaning-based: Association words

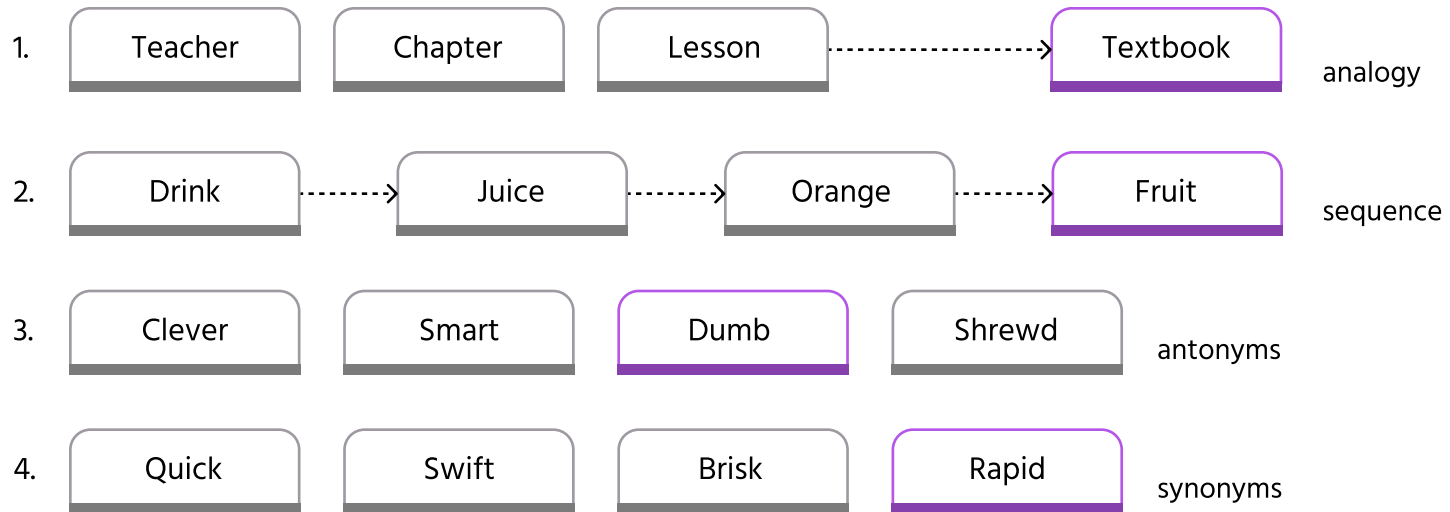


Figure: Meaning-based Association

Examples of associations created w.r.t the meaning of the words.

Word Formation: Association words

1.

<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; display: inline-block;">Hyper</div>	+	<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; display: inline-block;">Active</div>→	<div style="border: 2px solid purple; border-radius: 10px; padding: 5px; display: inline-block;">Hyperactive</div>	prefix
extreme				extremely active	
2.

<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; display: inline-block;">Arrive</div>	verb	+	<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; display: inline-block;">-al</div>	suffix→	<div style="border: 2px solid purple; border-radius: 10px; padding: 5px; display: inline-block;">Arrival</div>	noun	
We <u>arrived</u> at his house.			verb			We greeted the early <u>arrivals</u> .		noun
3.

Did you <u>text</u> her?		noun→	verb	conversion
--------------------------	--	------	--------	------	------------
4.

<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; display: inline-block;">Back</div>	+	<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; display: inline-block;">Ache</div>→	<div style="border: 2px solid purple; border-radius: 10px; padding: 5px; display: inline-block;">Backache</div>	compound
key feature of		⋮	Ache at the back	

Figure: Word Formation Association

Examples of associations created w.r.t the structure and formation of complex words.

Test

Phase 3, i.e. the test takes place at the end of each level. The design will be similar to the existing worksheets provided by schools. The questions will be application-based and will constitute a cumulative of the new words learned so far, irrespective of the interaction technique involved. It will contain a set number of questions and the scores will be recorded at the end, in a dashboard to track progress.

There is no pass mark and it is mainly to only keep track of the words that went wrong, in order to prioritize and repeat them in the following levels.

Active Recall

Spaced repetition is form of Active Recall that repeats information so that you remember it effectively. Spaced repetition has two parts: repetition and spacing.

Repetition follows the principle, “The more you repeat something, the better you learn it”. As for **Spacing**, “Learning that occurs from repetition is more effective when it is spaced out over time.”

In this case, the vocabulary content is divided into five boxes. All the words to be learned will be placed in the first box. If answered/recalled correctly, it will move to the next box and then to the next box, and so on. If answered wrong, the word is moved back to the first box to repeat every day. This method aligns well with the **forgetting curve** for memory retention in psychology.

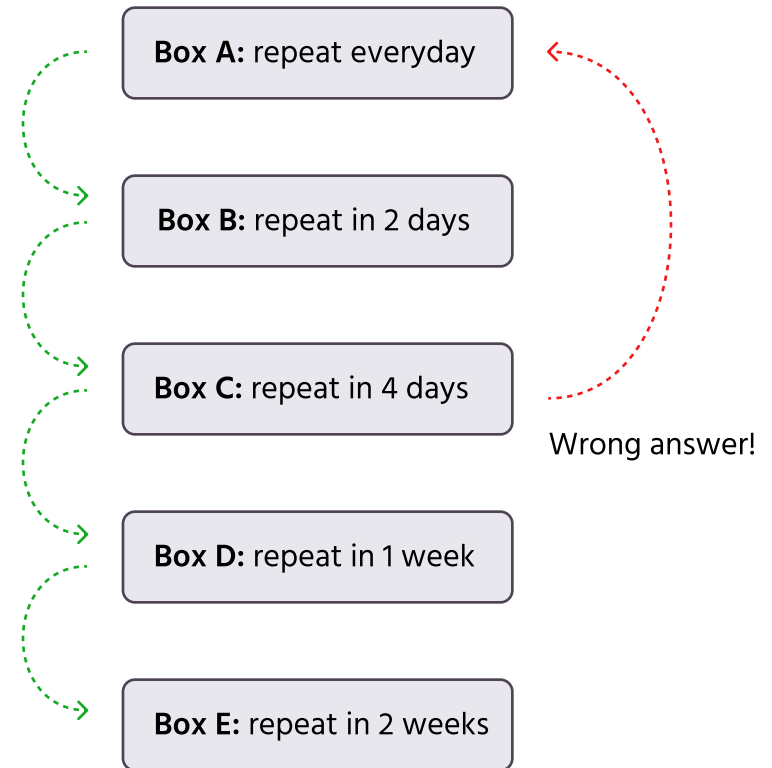


Figure: Spaced Repetition Strategy

Context Clues

There is an option of presenting hints whenever the user comes across a hurdle. “A reader should rely on context clues when an obvious clue to meaning is provided, or when only a general sense of the meaning is needed for the reader’s purposes.”

These hints a.k.a. Context clues will be provided in priority order of least helpful to most helpful.

The factors that influence the priority order for context clues are:

1. Clues that give a slight nudge towards disclosing the answer were given higher priority.
2. Clues that are most likely to come across in real life.

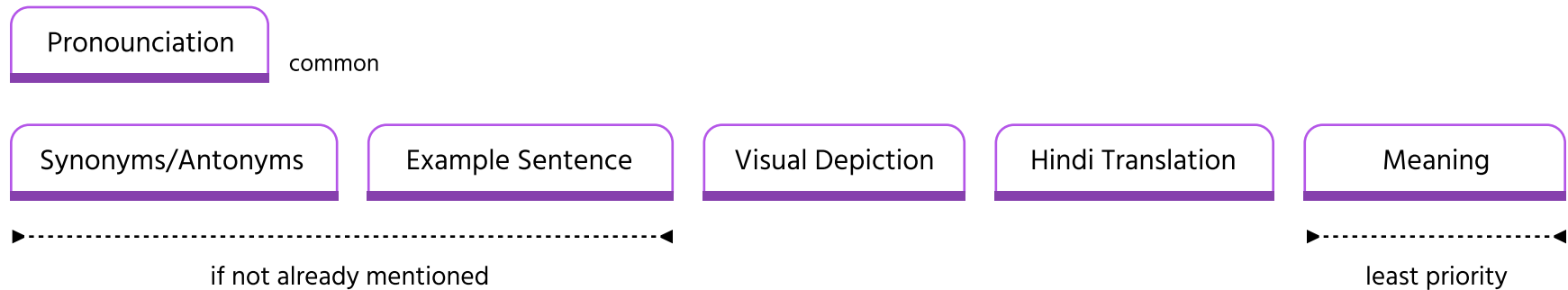


Figure: Priority Order for Clues/Hints

Content Distribution

The content is distributed across the levels based on the following factors:

1. Selected vocabulary words (know vs don't know)
2. Complexity of the interactions and potential confusion based on the content.

Three levels were detailed out (level 0, level 1, level 2) for now. The user would go through them level by level.

Level 0 is about testing their existing vocabulary knowledge and familiarizing themselves with the interface. Two-Three complex words would be introduced per day in this level. This level involves analogy and meaning-based word associations. Once completed with all the exercises, you get to the test to keep track of your mistakes.

Level 1 is the stage when word-formation techniques are introduced. The first two stages would be the same with newer words (including the ones already learned). This level goes up a notch by learning 5 new, complex words per day. Here, we would mainly focusing on the suffix - prefix techniques of word-formation. Once completed with exercises, you move on to the task.

Level 2 is where the base words get more complex and uncommon. Under word formation, conversion and compound are introduced. The number of new words learned from here on could range from 5-7 per day. The rest of the stages and the learning techniques involved would be the same.

From here on, the following stages (Level 3, Level 4, etc) will follow a similar pattern till a new word association technique is introduced.

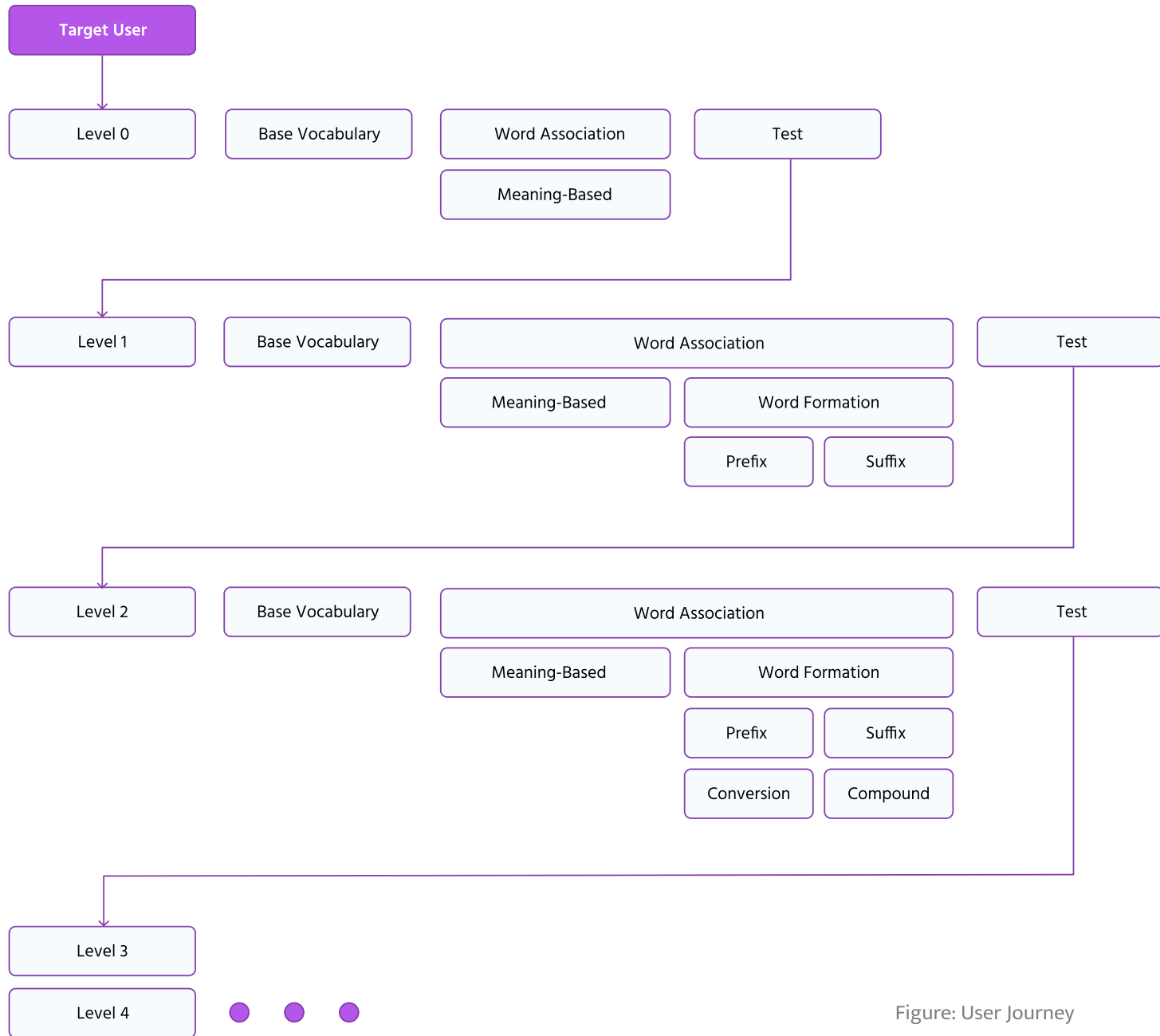


Figure: User Journey

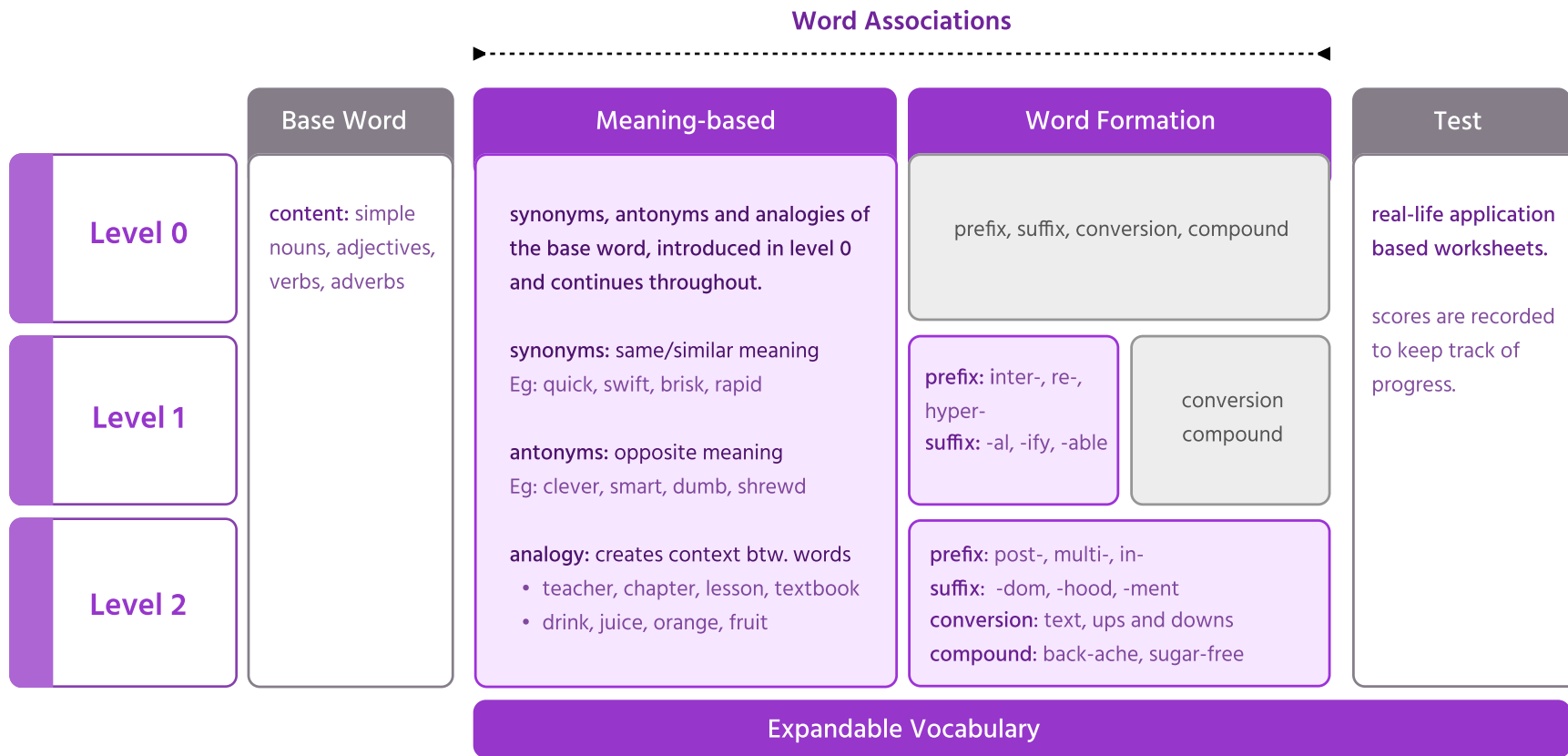


Figure: Expandable Vocabulary Structure across the Three Levels

Design Detailing (Screens)

The design detailing involves four main interfaces:

1. Introducing Base vocabulary
2. Meaning-based association strategies
 - a. analogy
 - b. sequence
 - c. antonyms
 - d. synonyms
3. Word formation association strategies
 - a. prefix
 - b. suffix
 - c. conversion
 - d. compound
4. Test interface

Since the project focuses on designing learning techniques, the screens are based on the word association strategies, explaining the flow with one example each.

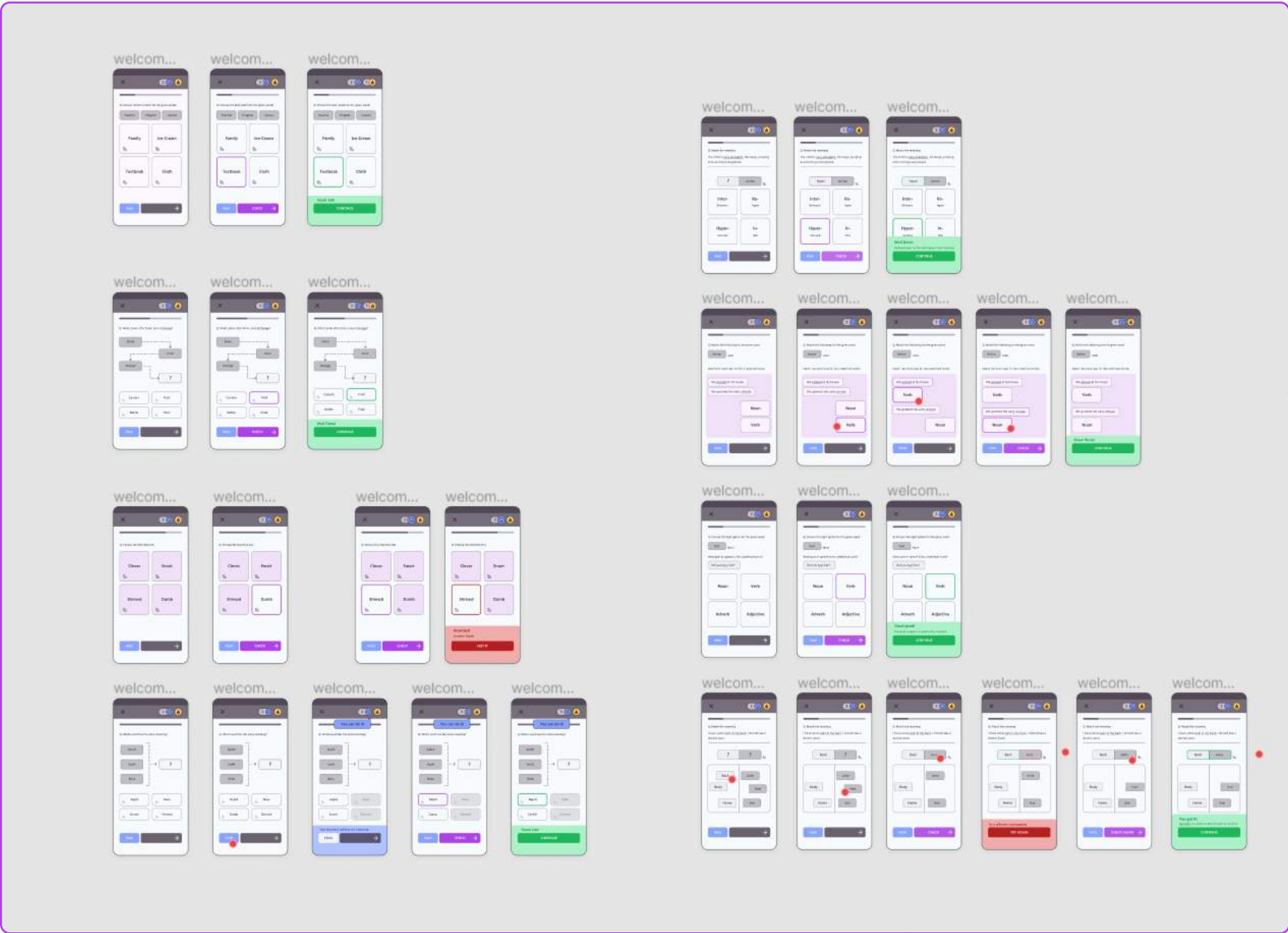
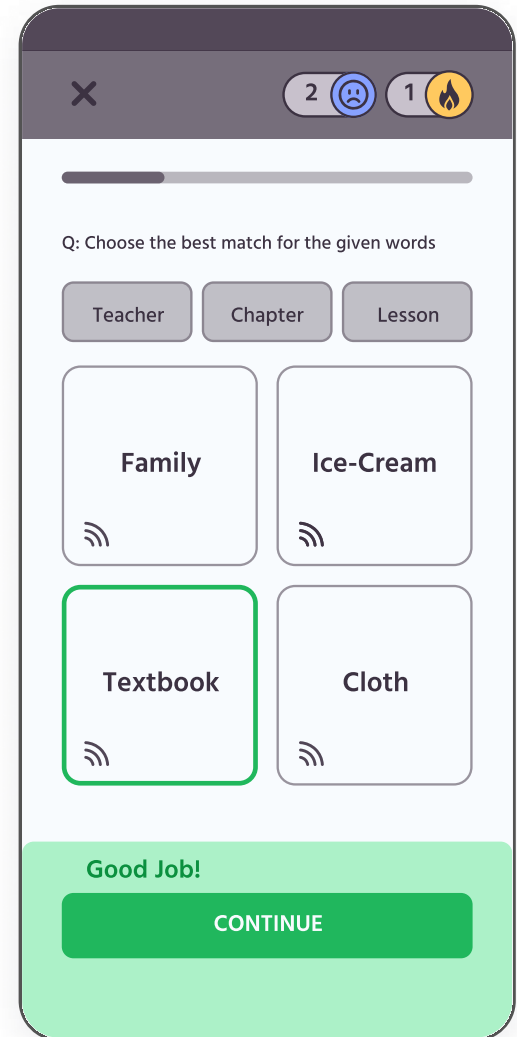
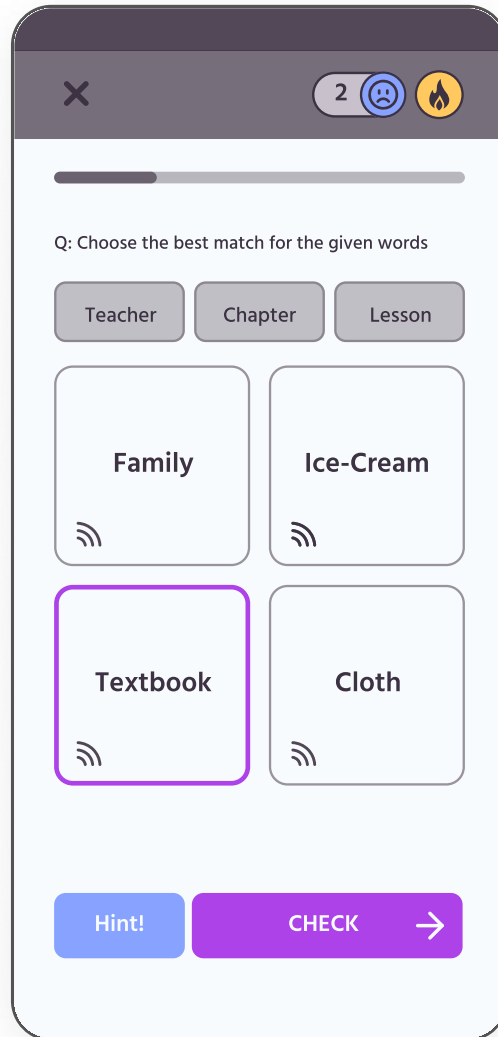
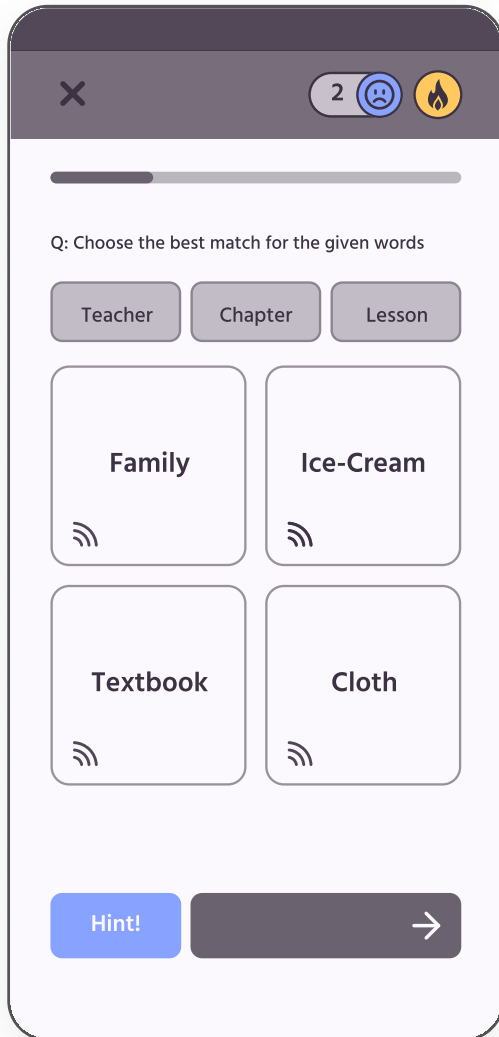


Figure: Preview of all Screens in Figma Board

1.1 Meaning-based Association: Analogy



1.2 Meaning-based Association: Sequence

Q: What comes after Drink, Juice & Orange?

Drink → Juice → Orange → ?

Camera Fruit
Bottle Chair

Hint! →

Q: What comes after Drink, Juice & Orange?

Drink → Juice → Orange → ?

Camera **Fruit**
Bottle Chair

Hint! **CHECK** →

Q: What comes after Drink, Juice & Orange?

Drink → Juice → Orange → ?

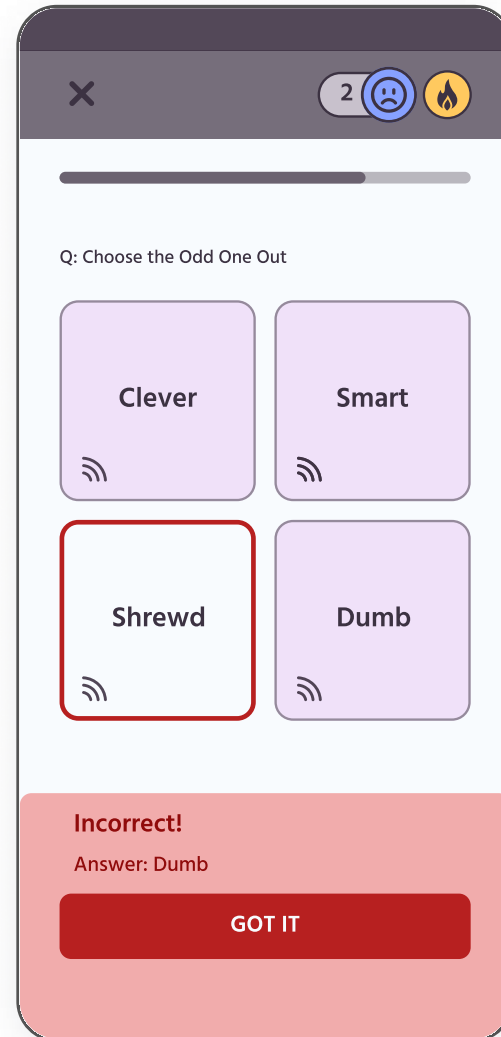
Camera **Fruit**
Bottle Chair

Well Done!
CONTINUE

1.3 Meaning-based Association: Antonyms

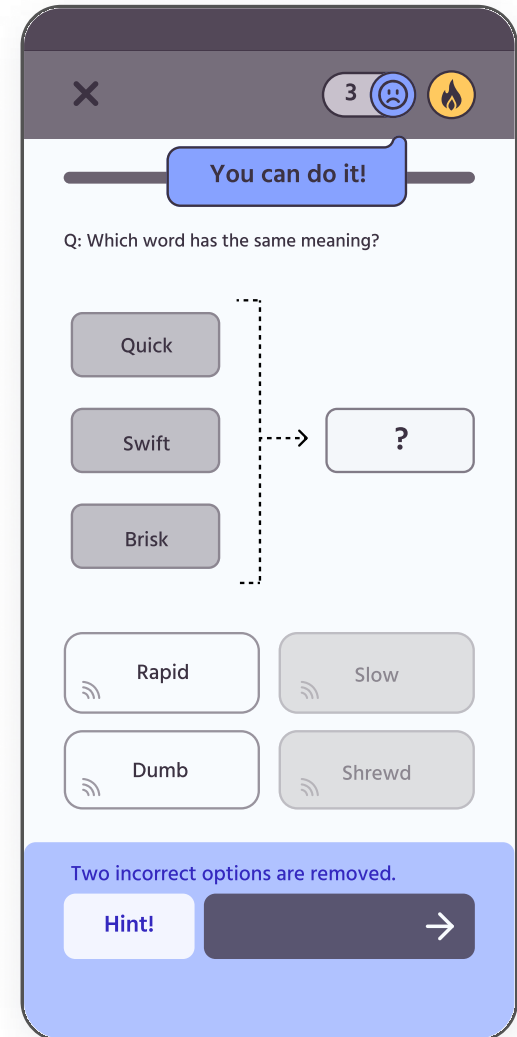
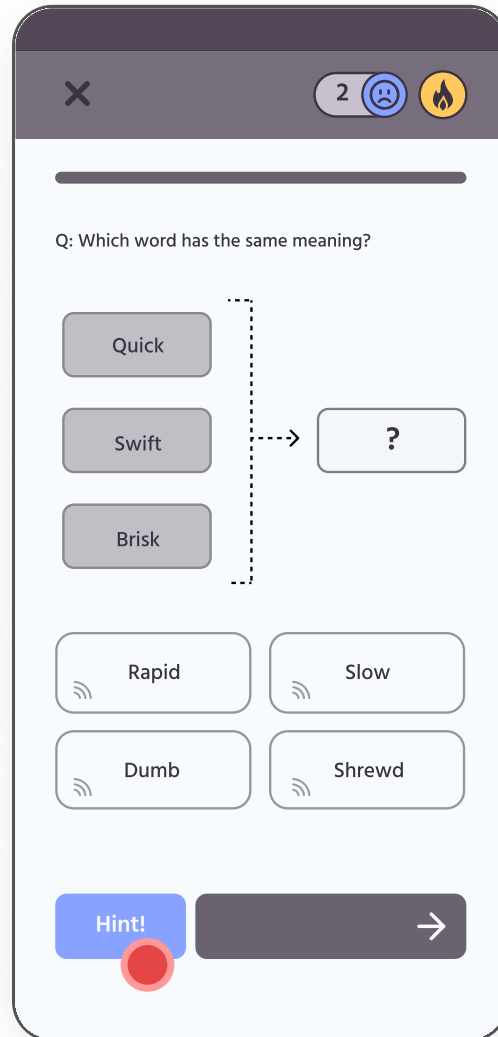
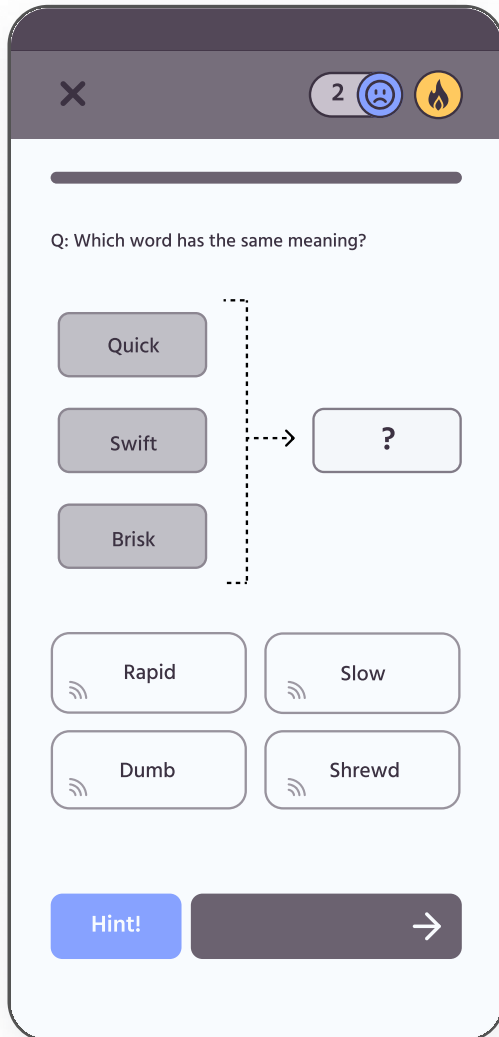


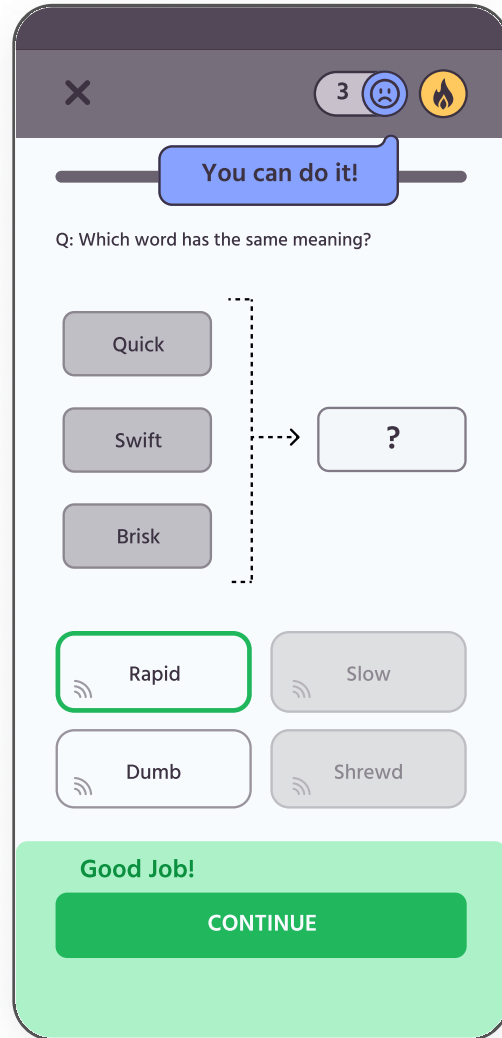
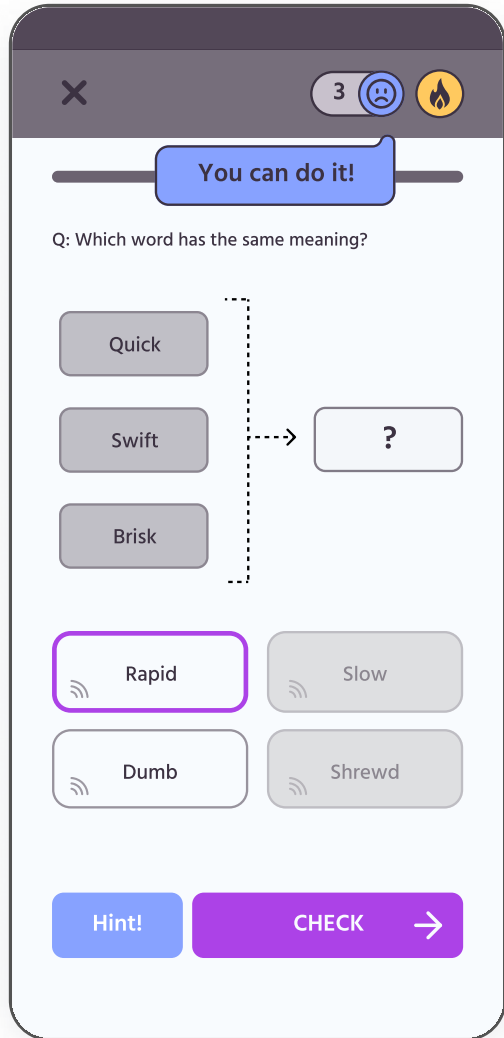
For an incorrect answer



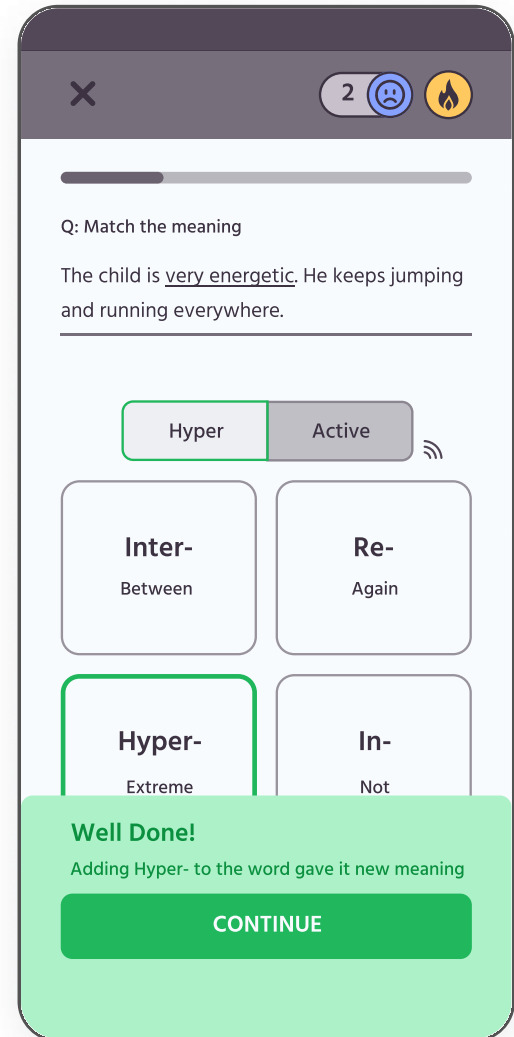
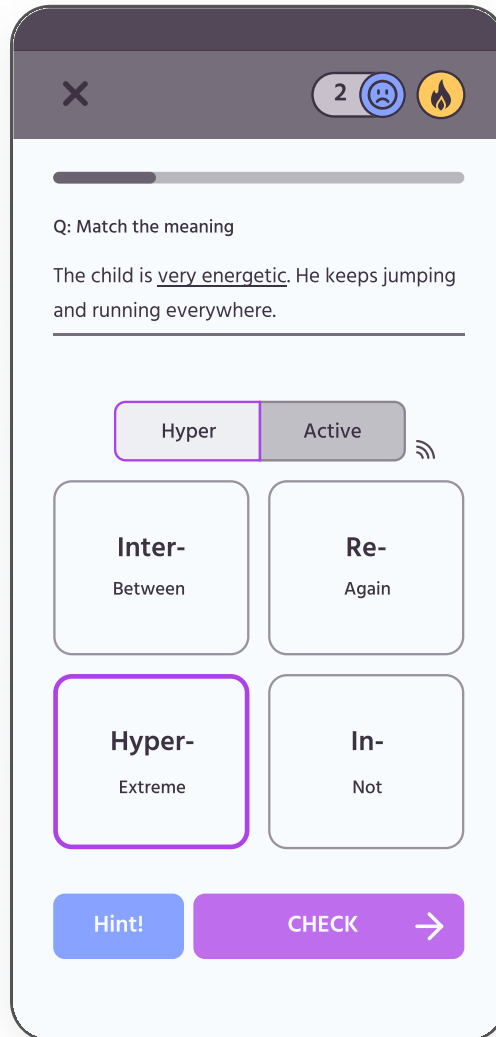
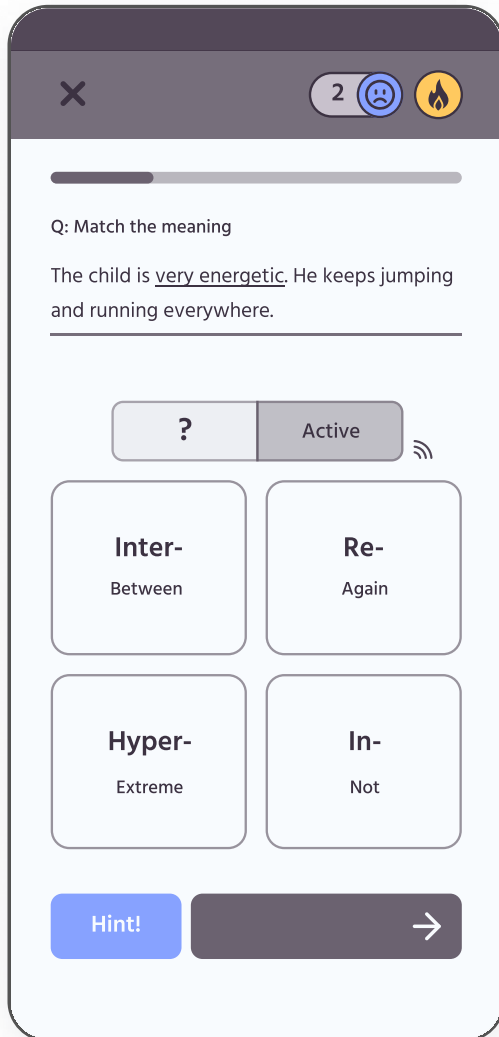
1.4 Meaning-based Association: Synonyms

Use of a Hint





2.1 Word-formation Association: Prefix



2.2 Word-formation Association: Suffix

Q: Match the following for the given word

Arrive Verb

Match the word class for the underlined words.

We arrived at his house.

We greeted the early arrivals.

Noun

Verb

Hint! →

Q: Match the following for the given word

Arrive Verb

Match the word class for the underlined words.

We arrived at his house.

We greeted the early arrivals.

Noun

Verb

Hint! →

Q: Match the following for the given word

Arrive Verb

Match the word class for the underlined words.

We arrived at his house.

Verb

We greeted the early arrivals.

Noun

Hint! →

✕ 2 😞 🔥

Q: Match the following for the given word

Arrive Verb

Match the word class for the underlined words.

We arrived at his house.

Verb

We greeted the early arrivals.

Noun

Hint! CHECK →

✕ 2 😞 🔥

Q: Match the following for the given word

Arrive Verb

Match the word class for the underlined words.

We arrived at his house.

Verb

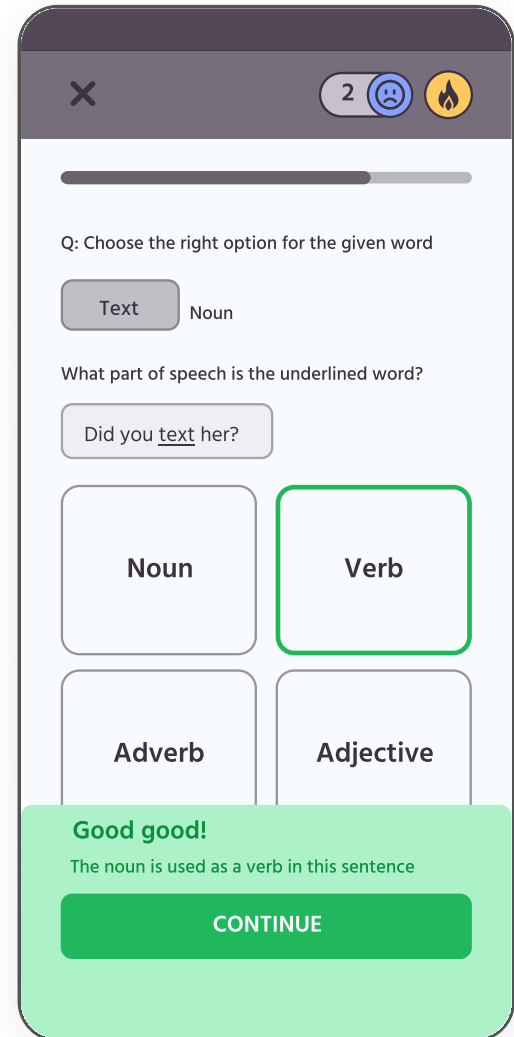
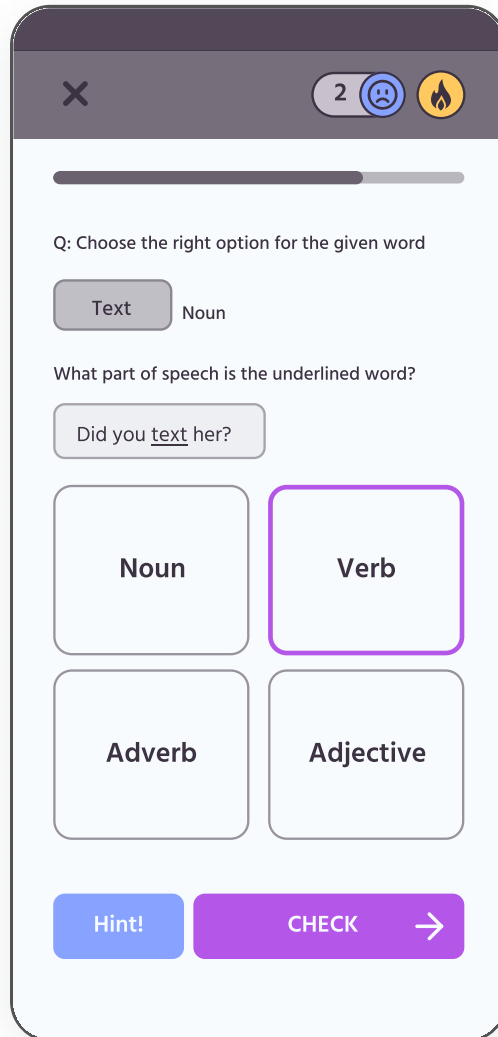
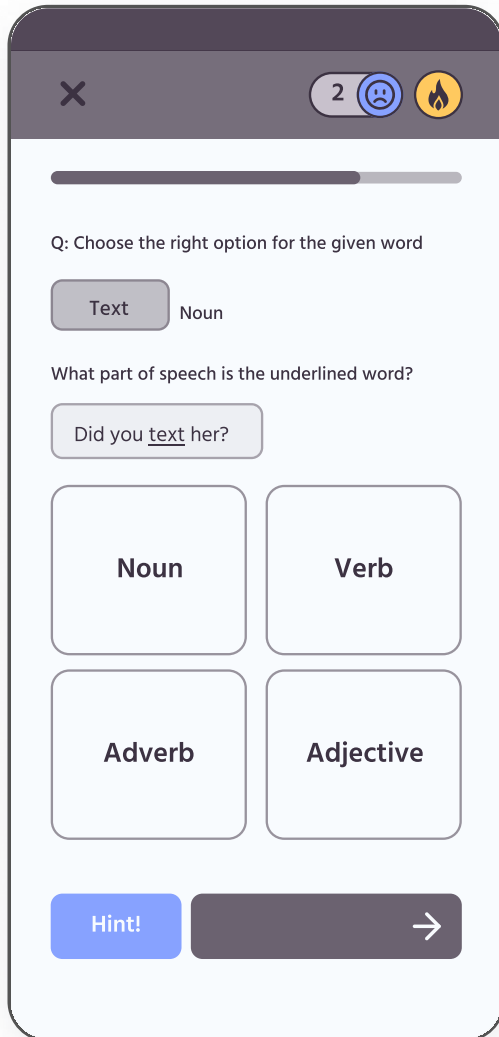
We greeted the early arrivals.

Noun

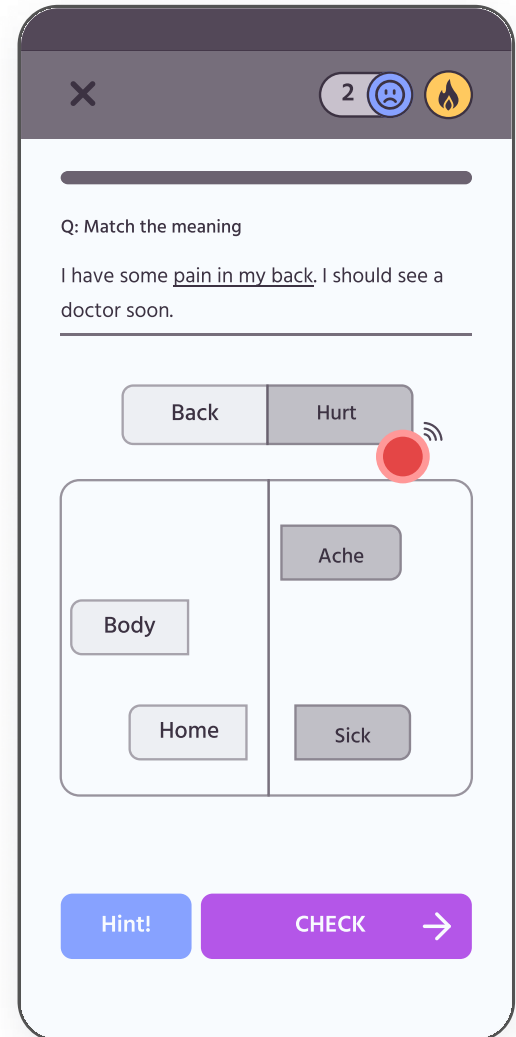
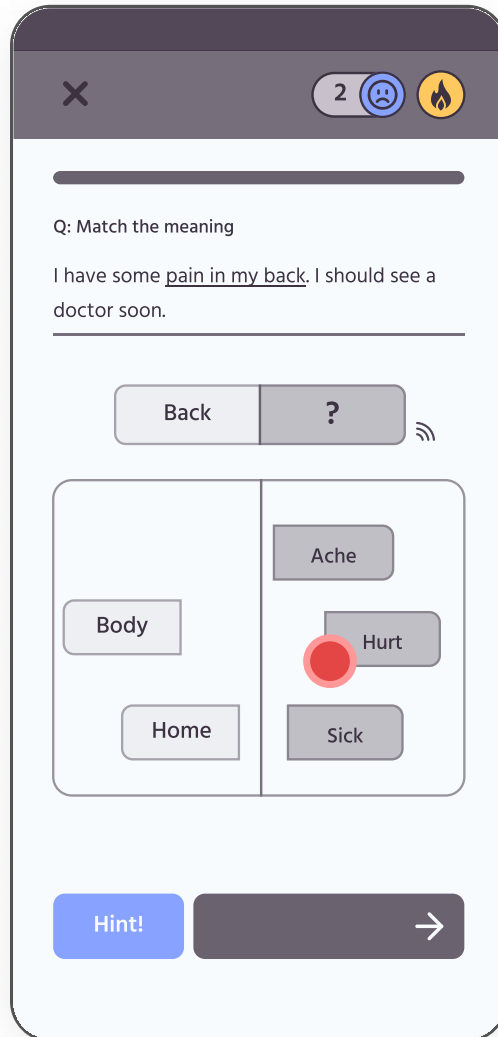
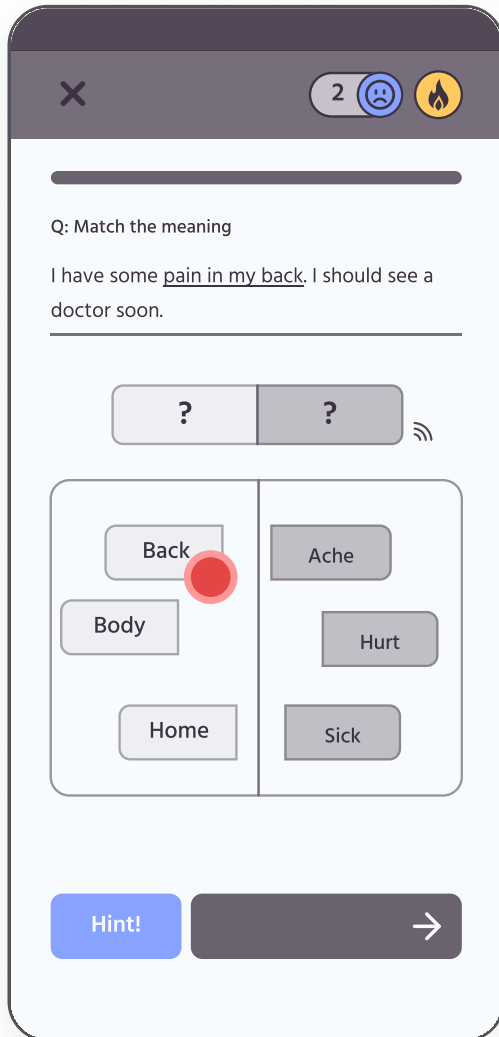
Great Work!

CONTINUE

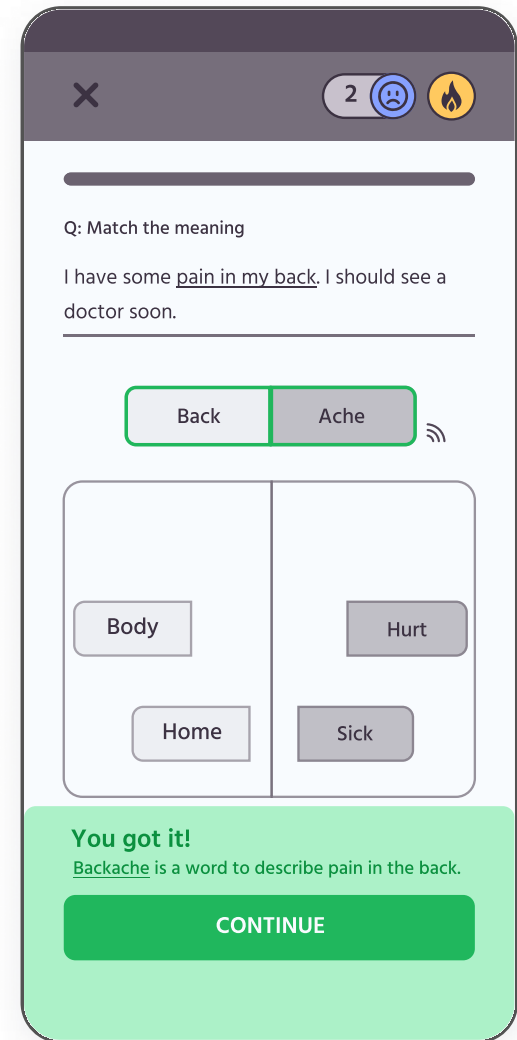
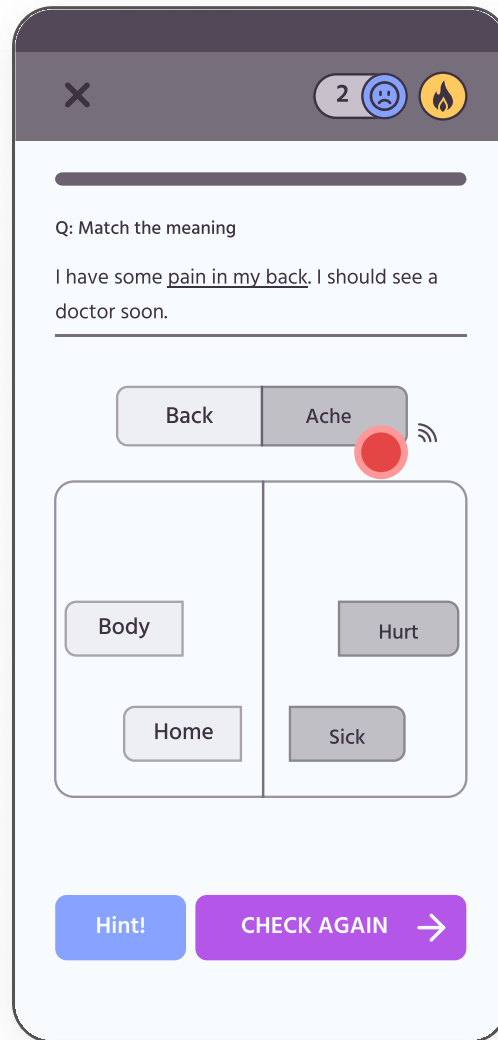
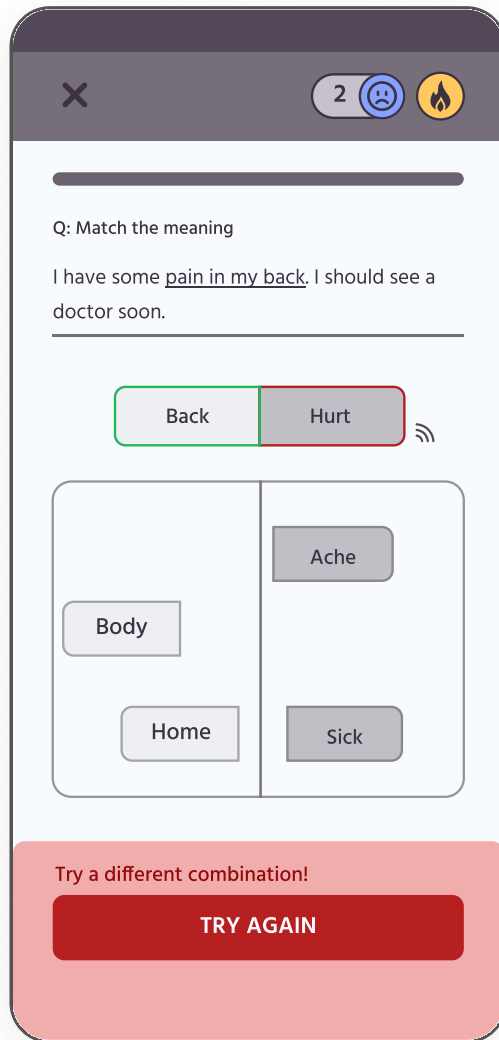
2.3 Word-formation Association: Conversion



2.4 Word-formation Association: Compound



Can try multiple times for the right word combination



Evaluation

The specified user group for conducting user testing was, Class 5th-6th students (aged 9-12) in Hindi medium schools with English as their second language. They are already familiar with the Roman script, and are currently improving their vocabulary.

The evaluation was conducted remotely over a phone call with two users. It had two parts: sorting and usability testing.

My focus was more on testing the interaction technique rather than the active recall technique (spaced repetition) as it is already proven and tested to work

Pictures of the screens designed were shared on whatsapp to the guardian/English teacher, at whose presence the user testing was conducted. The users were asked to think aloud while choosing and answer and making a decision. The following screens were brought up based on the user's response.

I started with playing the word association game to ease the students to user testing, while also noting their response on how the relations are formatted. (personal relations)

I then provided them with a set of words and asked to group them in any explainable. (sorting)

Introducing them to the screens was the final step in understanding their responses to learning strategy and the user flow.

The evaluation process I followed wasn't as elaborate as I expected it to be and the experience was quite interesting but diminishing as my only source of "observations" was the user (student) saying something and the adult confirming it.

Findings

These are the main findings from the User-testing and Evaluation exercises.

Word Associations, not just meaning-based

The students had fun in the first exercise, they blurted out the first word that came to their minds, which in some cases made less sense if you just compare the meanings.

For example: Instead of Apple = Fruit (the most likely answer), they also said, Apple = Ball because they were conditioned to think “A for Apple”, “B for Ball” etc.

All English Interface

Since the language chosen throughout the application was English, the students seemed a little uncomfortable. When asked about it, the teachers reasoned how “All- English” text is only present in their English textbooks, and they are reluctant to open it because of unfamiliarity with the language.

Meaning could be personalised

In the first section, meaning-based word associations, while the answers were obvious, but the users tried creating a personalized relation with given word, which was not the right answer.

For example; for **1.2 Sequence**, Drink, Juice, Orange, Fruit, the student also said Camera because he had an orange camera at home i.e. Drink, Juice, Orange, Camera.

The question was confusing than the answer

In the second section, word-formation word associations, even when the students knew the meaning of some words at first glance, some questions were structured in a more complex way that in turn confused the students.

Conclusion

English is taught as a second language from classes 5-7 in most Hindi Medium Schools and students are struggling with it given their lack of exposure, motivation, and current sociological conditions. English is an important language in today's world, and if not learned well in the early stages, people face the repercussions and realize its importance much later. While the first step is to learn the script, the second important step is to master the necessary vocabulary words.

The solution explores different learning strategies for memorising vocabulary, based on the word and the emphasizing on the provided context. Even approach, which in this case, is word associations.

While the design is very surface-level, it can further be expanded by integrating multiple word association styles.

This was an exploratory project for me. It was an entirely new area to work with and came with its set of struggles. Working alone for four months, in a new and unknown territory was a great experience and learning for me.

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Appendix A: IRB Apporval

IITB-IRB/2021/050



IRCC, Office of the Dean R&D, IIT Bombay

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

Institutional Review Board (IRB)

October 26, 2021

To
Prof. Anirudha Joshi
IDC School of Design
IIT Bombay

Ref: Proposal No.IITB-IRB/2021/050

Sub:Review of the above-mentioned project proposal submitted on 14.09.2021

Dear Professor,

Thank you for submitting your proposal to the IITB Institutional Review Board(IRB) for review. The IRB has reviewed the proposal submitted by you.Based on the discussions, suggestions, and responses given by you, the following proposal is approved:

Proposal number : **IITB-IRB/2021/050submitted on 23Oct2021**
Title : **Vocabulary memorizing application for Hindi Medium School Students from Classes 5-7 with English as Second Language.**

The IRB approval is for the ethical conduct of the study. The study is approved for the entire duration and aclosure report should be submitted within 2 months of the completion of the study.

Further, it isalso confirmedthat neither you, nor any of the study team members have participated in the decision-making process of the committee.

In case there are any changes in the proposed work (which is not limited to scope, dates, participants and methodology etc.), please communicate to IRB within 15 days of such a change.

Thank you.
With Best wishes from IRB for your study.

Virendra Sethi
Chairperson IITB-IRB

Appendix B: IRB Proposal

IITB-IRB/2021/050

Institutional Review Board Application

SECTION A : Details of project and investigator(s)

1. Title of research project:

Vocabulary memorizing application for Hindi Medium School Students from Classes 5-7 with English as Second Language.

2. Level of IRB review: 2

3. Name of Principal Investigator/
Supervisor (if student research):

Dr. Anirudha Joshi

Departmental affiliation(s)
Professor, IDC School of Design
IIT-Bombay

4. (a) Name(s) of student(s) involved (b) Degree programme (if student research),
e.g., MSc/PhD

1. Drishti Das

BDes student (4th year)

5. Name and status of other investigators, including Co-PI's from other
institutions/organizations, student investigators and professional collaborators:

- NIL -

6. List of location(s) where project will be conducted: [13. Expected study sites]

- Most of the interviews for this study will be conducted remotely in online mode. (Phone calls, WhatsApp video calls or Video conferencing platforms)
- Some interviews will be conducted face-to-face in **Mumbai, Maharashtra and Visakhapatnam, Andhra Pradesh** at locations convenient to participants, in a well ventilated/open space adhering to covid safety protocols.

7. Anticipated start date of the project: 29/09/2021 (Tentative)

8. Anticipated end date of the project: 29/09/2022 (One year from the start date)

Section B: Basic Assessment

This section determines whether your study raises more complex issues which require a full IRB review.

Appendix C: Consent Forms

IITB-IRB/2021/050

Informed Consent Form (in English)(User Study)

You are invited to participate in a study titled "Vocabulary memorizing application for Hindi Medium School Students from Classes 5-7 with English as Second Language".

The study will take about 30 to 45 minutes of your time.

IDC School of Design, IIT-Bombay is working on a research project to understand experiences and difficulties faced by Hindi medium school students who are learning English as a second language to develop an English vocabulary memorizing application.

In this regard,

I would be asking a few questions on teaching methods/strategies used for English as a second language, needs, motivation, extent of exposure to the language, other platforms you use to learn, difficulties with learning the language (specifically vocabulary) and how do you overcome them.

Your participation is completely voluntary and you are free to discontinue at any point. The study involves no risks or harm or any adverse effects. The study does not involve any reimbursements.

These data will remain completely confidential and will be maintained till the conclusion of the project. It will be used only for research purposes in an anonymized format, i.e. Your personal details like name, address, contact details will be stripped out.

PI Name: Anirudha Joshi

Address: Professor, IDC School of Design, IIT-Bombay

Email: anirudha@iitb.ac.in

Phone: 91-022-25767829

If you have any questions at a later date you may write to irb@ircc.iitb.ac.in.

GUARDIAN'S CONSENT FORM (in English) (Evaluation)

Your child is invited to participate in a research study conducted by Drishti Das (IDC School of Design, IIT Bombay). In this study we will try to understand the experiences and difficulties faced by Hindi medium school students who are learning English as a second language to develop an English vocabulary memorizing application.

Your child was selected as a possible participant in this study because he/she is a Hindi medium school student with English as their second language. If you decide to allow your child to participate, he/she will take part in testing our digital prototype conducted by me and give feedback and suggestions for improvement. The interactions will be observed and audio/video-taped. We may study and photograph Your child's English notebooks. This study will happen remotely through virtual mode (or) face-to-face (depending on his/her convenience). The evaluation is a short duration of 1-2 weeks from XX/XX/2021(tentative).

Your child's participation is voluntary. If you decide to allow your child to participate, you and/or your child are free to withdraw your consent and discontinue participation at any time before or during the study without penalty. We will anonymize the data collected from your child (e.g., blur the face from video recordings, remove references to the child's name, etc.). Any information obtained in connection with this study that can be identified with your child will remain confidential and will be disclosed only with your permission.

If you have any questions about the study, please feel free to contact Dr. Anirudha Joshi (Phone: 91-022-25767829; Email: anirudha@iitb.ac.in)

You will be offered to keep a copy of this form.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to allow your child to participate, that you and/or your child may withdraw your consent at any time and discontinue participation without penalty, that you will receive a copy of this form, and that you are not waiving any legal claims.

- I give permission for recording my child's audio during the study Yes / No
- I give permission for recording my child's video during the study Yes / No
- I give permission for my child to be interviewed by researchers Yes / No

Guardian's Signature: _____ Date: _____

Signature of Investigator: _____ Date: _____

