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A SUGGESTED MOBILE VOCABULARY INSTRUCTION APPLICATION: WORDBOOK

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ÖNERİLEN BİR MOBİL KELİME ÖĞRENİMİ UYGULAMASI: WORDBOOK

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ÖZET

Öğrenme artık sadece sınıfla ve öğretmenle sınırlandırılmamaktadır. Mobil destekli dil öğretimiyle, öğrenme özerliktik kazanmış ve geleneksel öğrenimin sınırlarının dışına çıkmıştır. Her geçen gün İngilizce dil öğreniminde önem kazınmakta ve bunun sonucu olarak, birçok dil öğrenimi uygulaması mobil markette yerini almaktadır. Ne var ki, bu uygulamaların büyük bölümü pedagojik ve metodolojik alt yapıdan yoksunlar. Türkiye'de, İngilizce dil öğreniminde kelime öğrenimi üzerinde durulması gereken meşakkatli bir konudur. Kelime öğrenimi sadece resmi eğitim ile geliştirilemediğinden, okul dışında da etkili bir şekilde sürdürülmelidir. Bunun bir yolu da resmi olmayan ve mobil destekli dil öğrenimi desteğiyle okullardaki müfredatın desteklenmesidir. Bu sebeple, bu çalışmanın amacı, İngilizce dil öğrenimine yeni başlayan öğrencilere, özellikle Türk okul öncesi ve ilköğretim öğrencilerine pratik bir kelime öğretimi aracını sunmak, bu şekilde worDBook olarak isimlendirilen mobil uygulamayı tasarlamak ve gerçekleştirmektir. Bu çalışma ayrıca, yazıları, sesleri ve resimleri ihtiva eden eğitim alanındaki araştırmacılar, öğretmenler, öğrenciler ve özellikle mobil destekli dil öğrenimi piyasasında yer alanlar için bir mobil uygulama modelidir. Uygulama tasarım tabanlı

araştırma modeline göre geliştirilmiş ve şu an Google Play mağazasında bulunmakta ve kullanıcılar ücretsiz indirebilmektedir.

Anahtar Kelimeler*:* İngilizce Dil Öğrenimi, Mobil Destekli Dil Öğrenimi, Tasarım Tabanlı Araştırma, mobil uygulama

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ABSTRACT

Learning is no longer limited to the classroom and is no longer only led by teachers. It became autonomous thanks to Mobile Assisted Language Learning (MALL). It breaks the boundaries of traditional learning. Every day, MALL gets more importance in ELT (English Language Teaching) and, thus, numerous language learning applications take their place in the mobile application market. However, most of those applications lack a pedagogical and methodological background. In Turkey, vocabulary learning is a challenging issue in ELT, which should be focused on. Because vocabulary instruction cannot be improved solely through formal education, it must also be maintained effectively outside of the classroom; one way this can be accomplished is if the curriculum implemented in the classroom can be supported by informal education or MALL. So, this study aims to suggest a practical tool of vocabulary instruction for new beginners in English language learning, especially for Turkish preschool and primary school students, thereby designing and implementing the mobile application of "worDBook". Furthermore, the study is a model of a mobile application with texts, audios, and pictures for educators, researchers, teachers, and students, as well as those in the MALL market. The application has been developed based on the Design-Based Research Methodology and is now on the Google Play Store and users can download it for free.

Keywords: ELT, MALL, Vocabulary instruction, Design-Based Research, Mobile Application

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LIST OF ABBREVIATIONS

ADC	:	Analog-to-Digital Converter
API	:	Application Programming Interfaces
APP	:	Application
CALL	:	Computer Assisted Language Learning
CPU	:	Central Processing Unit
DAC	:	Digital-to-Analog Converter
DDR	:	Design-Based Research
EFL	:	English as Foreign Language
ELA	:	English Language Acquisition
ELL	:	English Language Learning
ELT	:	English Language Teaching
ESL	:	English as a Second Language
GPS	:	Global Positioning System
HTML	:	Hyper Text Markup Language
IOS	:	iPhone Operating Systems
IPC	:	Inter-Process Communication
IT	:	Information Technology
JDK	:	Java development kit
LA	:	Lexical Approach
MALL	:	Mobile Assisted Language Learning
M-Learning	:	Mobile Learning
MMS	:	Multimedia Messaging
MSL	:	Mobile Second Language
OS	:	Operating System
PC	:	Personal Computer
PDA	:	Personal Digital Assistant
RAM	:	Random Accessed Memory
RF	:	Radio Frequency
ROM	:	Read Only Memory
SDK	:	Software Development Kit

SIM	:	Subscriber Identity Module
SLA	:	Second Language Acquisition
SMS:	:	Short Messaging services
SQL	:	Structured Query Language
SUS	:	System Usability Scale
Wi-Fi	:	Wireless Fidelity

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CHAPTER 1 - INTRODUCTION

Rapid developments in information technologies changed the traditional language learning and led the emergence of the m-learning. Geddes (2004) defines m-learning as the process of the learning and gaining a skill with a mobile device ‘anywhere anytime’. Learning is not any more just confined to the classroom and guided only by teachers. It became autonomous. M-learning has broken the boundaries of traditional learning not only in the context of the teaching of English as a second language (ESL), but also in the context of the English as a foreign language (EFL). So, the term of the Mobile Assisted Language Learning (MALL) emerged.

It is really popular nowadays. There are many mobile apps on the market that are used by both students and their teachers, or those trying to learn English. According to a new study, there were over 500.000 educational apps available on markets such as Google Play, Apple Store, and Windows in 2020, and this number is growing by the day (Riley, 2021).

From now on, I will begin with the problem of the study. Second, I’ll explain the aim of the study. Third, I will discuss the importance of the study. Fourth, I will talk about the assumptions and limits of the study. Fifth, I defined the terms in this study. I conclude the chapter with the scope of this study.

1.1. Problem

For distinct reasons, English became a lingua franca, and many people all around the world whose native language is not English are making an attempt to learn ESL or EFL. They attend a wide range of language courses and spend not only their precious time but also lots of money on them. After all this effort, it is still frustrating not to be able to learn English. For many years, many educators or philosophers have been trying to find a practical and efficient way to make this learning process as easy and economical as possible. They come across many different approaches, methods, and techniques to find a practical remedy for this issue.

No matter how they approach the issue, they place importance on vocabulary learning for English Language Teaching (ELT). Sarıçoban (2018) claims that vocabulary instruction, as being an essential part of communication, is crucial for ELT. In Turkey, vocabulary learning is a challenging issue in ELT, which should be focused on. Because vocabulary instruction cannot be improved solely through formal education, it must also be maintained effectively outside of the classroom; one way this can be accomplished is if the curriculum implemented in the classroom can be supported by informal education or MALL.

Every day, MALL gains more importance in ELT, and thus, numerous language learning applications take their place on the mobile app markets like Google Play and Apple Store. However, most of those apps lack a pedagogical and methodological background. They should be developed based on a methodology of learning instructions.

1.2. Purpose of the Study

The purpose of the study is basically to propose a mobile application for vocabulary acquisition based on the methodological background for new beginners in English language learning, especially for primary school students. The study has three objectives. The first one is to design and implement a mobile app named worDBook. The second is to gather users' views about the app. The third goal is to provide a mobile app model that includes text, audio, and images for educational researchers, teachers, and students, as well as those in the MALL market.

1.3. Importance of the Study

Turkey, a country that aims to join the European Union, places more importance on ELT in almost all educational institutions. Considering the number of resources allocated to this issue, it is not difficult to understand how important it is for the country. One of the most essential parts of ELT is certainly vocabulary instruction. As mentioned before, MALL offers an important opportunity for vocabulary learning. However, there are numerous apps for this goal, but only some of them have been developed in accordance with an effective methodology. So, the worDBook app can help both teachers and students, even those intending to learn English, by considering this lack. This vocabulary instruction app, by possessing both visual and audio support alongside text, enables learners to enhance their vocabulary capacities, which ultimately contributes to the development of other English skills including speaking, reading, writing, and listening.

According to Harmer (2015, p. 97), teachers are the creators of autonomous learning, in which students take their own responsibilities for learning. Thus, students need to be guided by their teachers to make use of MALL, especially mobile vocabulary learning applications. The study by Qian and Tang (2018) confirms this support. It reveals that the majority of students in the research need their teachers' support for MALL. As stated by Hoi and Mu (2021), teachers play a critical role in shaping students' behaviors by using mobile-assisted language learning inside and outside classrooms. Vocabulary learning gains autonomy with this app and becomes flexible and practical without any constraints of time and place. As language learning extends to outside schools, this app is to help the learners maintain it. So, it aims to support the students at primary school in ELT. The goal of the worDBook, which is student-centered and accessible from anywhere and at any time, is to attract both students and teachers. To be more concise, this study is significant not only for providing a mobile vocabulary instruction app for new learners of the English language in an EFL context, but also for being an interdisciplinary project as the development of the app requires both knowledge of second language acquisition and software engineering.

1.4. Research Questions

The purpose of the study, as aforementioned, is to offer a mobile-assisted vocabulary learning app for new beginners in English language learning, especially for primary school students, so for this purpose, the study looks for the following research question:

RQ. Is it possible to develop and implement the app named worDBook for the primary school students successfully?

1.5. Assumptions and Limits of the Study

There are a few assumptions in this research. To start with, in the EFL context, vocabulary learning mainly takes place in formal settings, in other words, in classrooms under the teachers' supervision. It is assumed that the time spent on this activity is not enough for both teachers and students to study the words of any lesson, so this learning process should be continued outside of the school context. Second, it is assumed that there are some practical mobile vocabulary learning apps that teachers can offer to students to carry out their vocabulary learning activities outside of school. Third, it is assumed that teachers have skills in evaluation of mobile vocabulary learning apps and that all students can reach a mobile device on which the app offered by the teacher can run. Last but not least, it is assumed that the app, worDBook, will be accessed through Google Play.

Besides the aforementioned assumptions, the worDBook app has some limitations that should be considered by those interested in this study. To begin with, the primary goal of this application is to teach vocabulary, but it is crucial to realize that English learning is much more than that. Second, the app is limited to Google Play to be downloaded, so it can only be used on some tablets and smartphones that use the Android Operating System with a version of 4.1 and higher. Third, it has a limited vocabulary list unless updated by the developer. Last but not least, the vocabulary on the app mainly covers primary school English language books.

1.6. Definition of Terms

Throughout this paper, these are the terms with their definitions:

Vocabulary is a list consisting of many words to be learnt in the targeted language (Nunan, 1999).

Vocabulary instruction is a the process of learning words in a target language (Nordquist, 2019).

Mobile-learning or m-learning is a learning process and gaining skills with a mobile device at any place and any time (Geddes, 2004).

Autonomous learning refers to self-guided learning. It is very efficient owing to one’s own choice (Urip, n.d.)

A strategy is a plan or tactic that enables someone to achieve a goal.

Approach is beliefs, assumptions, and theories regarding language learning and the nature of language (Brown, 2000, p. 14).

Method relates to how the teaching will be performed (Lewis, 1993, p. 1).

Methodology is generally the teaching practices consisting of both theoretical basis and relevant research (Brown, 2000, p. 15).

Technique refers to any activity, exercise, or task used in the classroom (Brown, 2000, p. 16).

Syllabus is the content of a teaching program.

Operating system refers to the software that directs the processing of programs and governs the functioning of a computer (as well as allocating memory space and regulating both functions of the input and output) ("Operating System," n.d.).

1.7. Scope of the Study

This paper is to continue with the literature review, and it is to be followed by the methodology. Last but not least, a conclusion and suggestions for the researchers and educators are to be provided.

CHAPTER 2 - LITERATURE REVIEW

There have been many attempts to enhance vocabulary acquisition in second language acquisition, and MALL is one of them. Even though there are numerous mobile apps that have been developed for vocabulary instruction, many of them lack pedagogical and methodological background. The present study offers the development of a mobile app that aims at providing vocabulary instruction for students at Turkish primary schools.

In this chapter, I start with the theoretical framework that explains all the aspects of vocabulary instruction and knowledge. Then, I continue with explicit and implicit vocabulary learning. After this, I will explain Computer Assisted Language Learning (CALL) and then MALL. Last but not least, MALL and vocabulary learning are to be focused on.

2.1. Vocabulary Instruction

This section of the study explains the vocabulary instruction and important relevant points. I will start with its definition and importance. Secondly, I will continue with explanation of the word and its classes. Thirdly, I am going to explain what knowing a word means. After that, I concentrate on vocabulary teaching methods and, finally, learning strategies for vocabulary acquisition.

2.1.1. Vocabulary Definition and Importance

Vocabulary is a list consisting of many words to be learnt in the targeted language (Nunan, 1999, p. 101). Similarly, Graves (1986) defines it as "the entire stock of words belonging to a branch of knowledge or known by an individual". Both definitions refer to a collection of words belonging to a subject area.

As well known, words are an indispensable part of a language. The more you have, the easier it will be to express something. In other words, they are somewhat like ammo that a soldier has in a war; as long as he or she has them, they will be able to keep fighting. Wilkins (1972, as cited in Sarıçoban, 2018, p. 124) asserts the significance of vocabulary as "without grammar very little can be conveyed, but without vocabulary nothing can be conveyed". According to Krashen (1982, p. 80), vocabulary is essential not only for comprehensible input but also for grammar. He also states that vocabulary instruction helps understand syntax. There are some scholars that underscore its significance for communication competence as well. Brown emphasizes the importance of vocabulary for communicative language as follows:

> Words are basic building blocks of language; in fact, survival level communication can take place quite intelligibly when people simply string words together-without applying any grammatical rules at all! So, if we're interested in being communicative, words are among the first priorities. (2000, p. 377),

Similarly, Sarıçoban (2018, p. 124) claims that vocabulary is crucial for ELT because it is an essential part of communication. In order to emphasize the significance of vocabulary knowledge, like Sarıçoban, Folse (2004) states, "Lack of grammar knowledge can limit conversation; lack of vocabulary knowledge can stop conversation". Oxford & Crookall (1990) states in most classes of language teaching, vocabulary learning, rather than being ignored, should become a top priority for teachers when the difficulty of vocabulary learning is considered in EFL or ESL context. Some empirical research shows the vocabulary knowledge effect on different language skills. Oxford & Crookall (1990) argue that knowing an L2 word includes both knowing the meaning and knowing how to use it effectively in one of the four skills of language. The research reveals that vocabulary knowledge has a favorable impact on writing productivity (Laufer, 1998), and receptive and proactive skills of listening and speaking (Joe, 1995).

The English language, like many other languages, is highly rich in words, and thanks to new technological and medical developments, this richness is increasing steadily. The stock is so extensive that it is not possible for a native speaker to know the whole stock of English words. As for learners and teachers of SLA, what to learn or teach is a really big issue. According to Nation and Newton (1996, p. 238), the priority of language learning should be 2,000 "highly-frequency words" at first, after which learners can progress to academic, technical, and low-frequency words. Similarly, Schmitt (2007, p. 828) states that for daily life communication, the range of the most commonly used English words that someone should know is 2,000 to 3,000. Also, he claims that an SLA learner with knowledge of a collection of 10,000 most frequent words may be assumed to possess a broad vocabulary. According to Hazenburg and Hulstijn (1996, as cited in Schmitt, 2007, p. 828), this vocabulary size could be sufficient for someone doing university studies in SLA. As aforementioned, vocabulary knowledge is essential for learners to develop their proactive skills of speaking and writing, and receptive skills of listening and reading.

So as to comprehend this stock of words, I will explain the aspects of words. The next topic includes word definition, word classes, and word meaning and form.

2.1.2. Word Definition and Classes

According to Oxford Learner's Dictionaries, a word is defined as a single linguistic unit that means something, also may be written or spoken ("Word," n.d.). It is also referred to as "the basic unit of VOCABULARY" (Hartmann & James, 1998, p. 155). According to the linguistic approach, words are lexicological units called LEXEMES (1998, p. 155). Words can be divided into content words and function words (Sarıçoban, 2018, p. 125).

According to Sarıçoban, content words are words that have meaning because of their references (e.g., a pilot who flies an aircraft) (2018, p. 125). These content words are classified as follows:

- *Verbs:* words that refer to actions (e.g., climb, fly, run).
- *Nouns:* words that name people, animals, or things (e.g., Tom, cat, book, smoking). Nouns are the biggest word class among verbs, adjectives, and adverbs ("Nouns," n.d.).
- *Adjectives:* words that describe the qualities of nouns (e.g., pretty, sad, yellow).
- *Adverbs:* words that modify word classes, including verbs, adjectives, and their own (e.g., Ali runs *fast*, she is *very sad*, he does not drink *any more*).

On the other hand, he states that all other worlds apart from verbs, nouns, adjectives, and adverbs are function words (2018, p. 125). They are summarized as follows:

- *Pronouns:* words that are used as nouns or noun phrases. The types of pronouns are shown in Table 1.

Table 1:Types of Pronouns

Type	Examples
Subject	I, you, she, he, it, we, you, and they.
Object	Me, you, him, her, it, us, you, and them.
Possessive	Mine, yours, his, hers, its, ours, yours, and theirs.
Reflexive	Myself, yourself, himself, herself, itself, ourselves, yourselves, and themselves.
Interrogative	Who, what, which etc.
Demonstrative	This, that, these, and those.
Indefinite	-one, -body, -thing, one, you, they, etc.
Reciprocal	one another, one another's, each other, each other's etc.
Relative	That, who, whom, whose, which, when etc.

- *Prepositions:* words that depict the relationship between verbs, nouns, adjectives, and adverbs (e.g., at, on, in, from) ("Word Classes and Phrase Classes," n.d.). They are mostly used between nouns. For instance, the time *of* the checkout is ten o'clock (illustrating the relationship between the time and the checkout).
- *Determiners:* words that come before nouns to depict quantity, possession, etc. (Hartmann & James, 1998, p. 38). They have the functions of referring and quantifying ("Determiners (the, My, Some, This)," n.d.). The common types of determiners are as follows:

  1. *Articles:* a, an, the (e.g., *a* book, *the* school).
  2. *Demonstratives:* this, that, these, those (e.g., *this* car, *that* market).
  3. *Possessives:* my, your, his, her, its, our, their, Ali's (e.g., *my* grade, *her* father).
  4. *Quantifiers:* few, a few, fewer, little, a little, many, much, more, most, some, any, a lot, lots of, a couple of, each, etc. (e.g., *a few* students, *little* money)
  5. *Numbers:* one, two, three, four, five, etc. (e.g., one *of* my books).

- *Conjunctions:* words that connect words, phares, and sentences ("Conjunctions," n.d.). They are categorized as follows:

1. Coordinating conjunctions connect the items that have the same grammatical type. They are divided into one-word coordinating conjunctions (e.g., and, or, but, yet) and two-word coordinating conjunctions (e.g., either … or …, neither … nor …, not only … but also …, both … and …). For example:

- Apples *and* oranges are fruits (one-word coordinating conjunction).
- *Both* Jack *and* Alice go to the primary school (two-word coordinating conjunction).

2. Subordinating conjunctions complete a main clause. Like coordinating conjunctions, they have one-word subordinating conjunctions (after, before, though, although, as, because, if, since, that, until, when, whereas, while, once, so) and subordinating conjunctions that are more than one-word (as soon as, provided that, as a result). For instance:

- *After* school, I will visit you.
- The rain started *as soon as* she stepped out.

- *Interjections* are the words of exclamations (e.g., oh!, wow!, yippee!, gosh!) and depict someone's reaction to a situation or an event ("Word Classes and Phrase Classes," n.d.).

2.1.3. Meaning and Form of the Word

Words have different meaning, and thus, the word context governs the word meaning. On the surface, the meaning of a word looks simple, but some situations show that it is not as it is (Harmer, 2015, p. 25).

I bought a *book* yesterday.

I *book* hotels through the internet.

These sentences show that a book goes beyond just naming an item. While "book" in the first sentence refers to an item, in the second one it refers to making a reservation. This example demonstrates how word meaning varies depending on context. According to Harmer (2015, p. 26), those words that have the same letters and sounds and have a variety of meanings are called *polysemy.*

A word's meaning is generally determined by its connection to other words (Harmer, 2015, p. 26). For instance, the meaning of *hot* can be explained by defining that it is not *cold*, which shows that *hot* is the opposite of *cold*. Words that have opposite meanings are named as *antonyms* (Sarıçoban, 2018, p. 126).

Words that have almost the same meanings and are substitutable for each other are called *synonyms* (Harmer, 2015, p. 26; Sarıçoban, 2018, p. 126) . A word can have more than one synonym (e.g., *constant* meaning taking place continually can be exchanged for continuous, unceasing, or fixed meaning depending on context).

The relationship between some words, which are identical in terms of form but different in terms of meaning, is called *homonymy* (Sarıçoban, 2018, p. 126). The words that have the same pronunciation are homophones (e.g., fare, fair) and those that are identical in form are called homographs (e.g., can (be able to), can (a container)).

Another issue related to word meaning is *hyponymy.* It can be defined as a word with a specific meaning which is contained within meaning of a more extended word ("Hyponym," n.d.). For instance*, w*ords such as *salad, bread, and pasta* are hyponyms for *food.* Similarly, *cats, dogs,* and *rabbits* are hyponyms for *animal.*

There are some words that are used to refer to things, places, people, or concepts that carry some of their qualities. These words are known as *metonyms*. For example, a white house for the president of the USA and wheels for a car are just two metonyms.

Another important aspect of words is word combinations. In English, words do not come together randomly. While some come together, others don't. Words that coexist with other words are known as collocations (e.g., *make a mistake*, *tell the truth*) (Ur, 2012, p. 72). Some research, like Lewis (1993, p. 121), extends the importance of collocations to lexical phrases or *chunks* named as "pre-fabricated formulaic items". Chunks are used to make various compound words (e.g., running shoes, bookcase, firefighter), phrasal verbs (e.g., put off, call off), collocations (e.g., do homework, make a reservation), functional phrases (e.g., anyway, all above, last but not least), and expressions (e.g., a can of worms, a close shave, never mind, cannot afford to) (Harmer, 2015, p. 28). Chunks refer to a single meaning even though they are multi-words. According to research (Harmer, 2015; Lewis, 1993) there is a close relationship between someone's ability to use chunks properly and fluency in language. Those that are capable of using chunks are more fluent.

In English, in order to avoid any ambiguity, word meaning should be drawn from the context, and students should be reminded that, depending on the context in which a term is used, it can have a variety of distinct meanings. Also, they should be aware that knowing what a word means includes various aspects of language.

2.1.4. Knowing a Word

Knowing a word, according to Nation (2001), means knowing its verbal and written forms, various meanings, and uses. Like Nation, Ur (2012, pp. 60–61) states that the most significant aspects of a word that a student should know are the word's written and verbal form, most common meaning, and other aspects including its grammar, collocations, relationship to other words, proper use, and L1 meaning. It means that teachers should focus not only on form but also on different meanings and their uses. This issue can be summarized as Schmitt (2007, p. 830) states, "The more aspects of word knowledge we know about a word, the more likely we will be able to use it in the right contexts in an appropriate manner."

As we get the essential parts of words, the question is how we can teach words, or "blocks of the language," effectively and without boring the students. The next section aims to present approaches to vocabulary instruction and then techniques and strategies for vocabulary instruction.

2.1.5. Approaches to Vocabulary Instruction

The process of learning a language's vocabulary is known as vocabulary acquisition (Nordquist, 2019). It is one of the most crucial parts of learning a foreign language. It aids in the development of learners' listening, speaking, reading, and writing skills. Although it is apparent that vocabulary education is required for learners to gain competency in a target language, no consensus exists on how it should be delivered.

According to Schmitt (2007, pp. 832–833), effective vocabulary learning should include both true recycling and revision. Otherwise, it cannot be successful no matter how the vocabulary is presented because the newly presented words are most likely to be forgotten. According to Russell, a revision pattern can be set up after 5-10 minutes following the first study, a 24-hour period, a week, a month, or six months (1979, as cited in Schmitt, 2007, p. 832). Schmitt (2007, p. 833) states that any specific vocabulary learning method does not sufficiently itself to be useful to respond to all the aspects of word knowledge. He says that vocabulary learning should be both explicit and implicit learning. While some aspects of word knowledge, like grammatical characteristics and meaning, can be given explicitly, other aspects such as collocation, register, and intuitions of frequency can be learned implicitly through extensive exposure to the target language in various contexts (e.g., classroom activities, reading, and being in one of the English-speaking countries for a certain time) (2007, pp. 833–834). Schmitt (2007, pp. 834–837) entitles the intentional learning of vocabulary as studying word pairs, groups of words, as well as cross-associations, contextual meaning, word families, word parts (e.g., affixes, prefixes), and sequences of words. He claims that learners are able to master a lot of vocabulary themselves if they are taught various vocabulary learning strategies (2007, p. 837).

Laufer (2003) states that incidental vocabulary learning is ineffective compared to deliberate vocabulary learning. In her research, she found that word-focused exercises are more successful than text-based vocabulary development, whether or not they are related to reading.

According to Ur (2012, pp. 64–65), it is possible for someone to learn their mother language incidentally, but incidental learning is not helpful for SLA in the context of formal settings or classrooms. He claims that vocabulary instruction should depend on both incidental learning and partially deliberate learning to support the incidental learning through extensive reading and listening. Ur (2012, p. 65) states that deliberate vocabulary instruction procedures are grouped into those that teach new words that are encountered for the first time and those that offer opportunities for word review so as to enhance the vocabulary knowledge of newly-learned words.

He states when introducing a new word, the procedure should include presenting written and spoken form, contextual meaning through pictures, realia, mine, gesture, or translation, and optimizing impact through using mnemonic techniques such as keywords to link new word with the word in L1, listing, pair words, grouping, emotional associations (2012, pp. 66–69).

On the other hand, for a learner to master a newly-learned word, several exposures are required (2012, p. 69). The most effective review for learners after learning new vocabulary is the next class. The gaps between reviews may be one week, two weeks, one month, and so on until permanently mastered. Some review activities and strategies are dictations, how many can you remember, quick bingo, guessing, composing sentences or a story, locating collocations, recapping new vocabulary at the end of the lesson, displaying new words in the classroom, recycling the words from the beginning to recently learned ones, using vocabulary notebooks, word cards, and listing new items on mobile devices (2012, pp. 70–71).

According to Harmen (2015, p. 258), vocabulary teaching includes introducing new vocabulary and practicing. He claims that reading a text and listening to an audio track are likely the best techniques to introduce new vocabulary. He entitles the introducing and vocabulary techniques such as associating words and chunks with pictures and sounds, visual clues for meaning, categorizing words, PPP-presentation, production, and practice, using dialogues, and practicing vocabulary techniques as matching words, word maps, describing and drawing, word lists, writing poems, games (e.g., choosing word cards competitively), using dictionaries, keeping vocabulary notebooks, and keeping small vocabulary cards (Harmer, 2015, pp. 258–275).

Brown (2000, pp. 376–377) states that for the sake of creating more authentic classrooms, the value of vocabulary was omitted for a long time. For communicative vocabulary instruction, he advises teachers to allocate particular time for vocabulary learning, to introduce meaning in context, to reduce students' use of bilingual dictionaries, to have students make strategies to get the meaning of words, and to conduct unplanned vocabulary instruction.

According to Sarıçoban (2018, pp. 130–131), the most practical vocabulary teaching through a text includes four stages: pre-activity, in the activity, post activity, and wrap-up. The pre-activity stage consists of (1) lead-in to create a context, (2) repetition and pronunciation, (3) conveying the word meaning, (4) writing it the whiteboard, (5) writing a model sentence, and (6) practice and use. The activity stage includes verifying students' comprehension of the contextual meaning of the vocabulary presented by the teacher and the production of students with the new words. The post-activity stage contains activities such puzzles, gap-fill, matching, etc. Finally, the wrap-up stage includes homework. Like Herman and Ur, Sarıçoban's vocabulary instruction consists of presenting new words, and practicing them both inside and outside the classroom. Sarıçoban (2018, p. 129) lists vocabulary teaching techniques as follows:

- Visual techniques (e.g., flash cards, drawings, photographs, wall charts, realia, mines, gestures).
- Verbal techniques (e.g., dialogues, stories, illustrative situations, sentences, synonyms, antonyms, etc.)
- Translation technique.
- Dictionary definition technique.
- Code-switching technique.
- Guessing from the context technique.

These techniques differentiate according to learners' levels. He maintains that using picture flash cards, explanation in L1, defining in L2 by the words that students know, commands, using real objects, and drawing are useful techniques for beginners (Sarıçoban, 2018, p. 130).

Unlike the above scholars, Krashen (1982, p. 81) claims that direct vocabulary instruction is unnecessary, and depends on sufficient comprehensible input through pleasure reading, by means of which ultimately vocabulary learning on its own takes place. He believes that comprehensive input provides a new word in frequency and gets learners to acquire the meaning of it.

It is obvious that for effective language learning, vocabulary instruction needs special attention, even if there are different approaches to how to do so. As Brown (2007, p. 114) states that there is no single theory that works in every situation while learning a second language. In addition to the context, every learner and every teacher is unique. Therefore, there is not such a complete method that can be applicable in all contexts and appropriate for learners and teachers, not only because of the uniqueness of every teacher and learner but also because of different contexts (Larsen-Freeman & Anderson, 2011, p. 280). Gardner (1987)'s theory of intelligence indicates that EFL classrooms are not homogeneous; while some are good at visual activities, others may be in other activities like problem-solving, listening, speaking, or writing. Thus, vocabulary instruction should take these personal differences into account to reach at least a majority of them as well. Larsen-Freeman and Anderson state that teachers' practices of teaching should be based on an eclectic approach and that teachers should make use of any techniques that are convenient for them and their context.

The aforementioned research indicates that effective vocabulary instruction depends on both meaningful activities for presenting and practicing vocabulary by using different strategies in the classroom and supplementary practicing activities outside the classroom to maintain this learning process. The next section aims to explain those strategies that are used for vocabulary learning by learners.

2.1.6. Vocabulary Learning Strategies

In this section, I will explain the definition and taxonomies of language learning strategies and techniques.

2.1.6.1. Definition and Taxonomies of Language Learning Strategies

Studies of strategies of learning go back to the beginning of the 1970s. The notion is that some language learners who have control over their learning process by using different strategies are more successful than others. Since then, those studies have gotten more attention. Scholars define strategy in a variety of ways. According to O'Malley and Chamot (1990, p. 1), "the special thoughts or behaviors that individuals use to help them comprehend, learn, or retain new information", for Oxford (1990, p. 8), learning strategies are "specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferrable to new situations", and for Ellis (1994, p. 532) "both general approaches and specific actions or techniques used to learn an L2". A strategy, according to Gu (2003), is a set of behaviors used by a student to promote the completion of a learning assignment. Cohen recently gave a more detailed definition of learning strategies as follows:

> Language learning strategies include strategies for identifying the material that needs to be learned, distinguishing it from other material if need be, grouping it for easier learning (e.g., grouping vocabulary by category into

> nouns, verbs, adjectives, adverbs, and so forth), having repeated contact with the material (e.g., through classroom tasks or the completion of homework assignments), and formally committing to memory whatever material is not acquired naturally through exposure. (Cohen, 2014, p. 12)

These definitions reveal that learning strategies have some common characteristics. They are intentionally chosen, practical, flexible, self-directed, teachable, and interlinkable with some other factors (e.g., social, communicative, cognitive, affective).

The field of research offers some well-known taxonomies of language learning strategies. When it comes to cognitive psychology, O'Malley and Chamot (1990) offer a taxonomy of language learning strategies including three major categories such as metacognitive strategies, cognitive strategies, and social/affective strategies. Besides that, another more extensive topology comes from Oxford (1990). The taxonomy of Oxford was separated into two categories: direct and indirect strategies. Table 2 shows the taxonomy in further depth.

Table 2: Oxford's Taxonomy of Language Learning Strategies

Major Group	Subgroup	Strategy
Direct Strategies		
Memory Strategies	Creating mental linkages	Grouping
		Associating/elaborating
		Placing new words into a context
	Applying images and sounds	Using imagery
		Semantic mapping
		Using mapping
		Representing sounds in memory
	Reviewing well	Structured reviewing
	Employing action	Using physical response or sensation
		Using mechanical techniques
Cognitive Strategies	Practicing	Repeating
		Formally practicing with sounds and writing
		Recognizing and using formulas and patterns
		Recombining
		Practicing naturalistically
	Receiving and sending messages	Getting the idea quickly
		Using resources for receiving and sending messages strategies
	Analyzing and reasoning	Reasoning deductively
		Analyzing expressions
		Analyzing contrastively (across languages)
		Translating
		Transferring
	Creating structure for input and output	Takin notes
		Summarizing
		Highlighting
Compensation Strategies	Guessing intelligently	Using linguistic clues
		Using other clues
	Overcoming limitations in speaking and writing	Switching to the mother tongue
		Getting help
		Using mime or gesture
		Avoiding communication partially or totally
		Selecting the topic
		Adjusting or approximating the message
		Coining words
		Using a circumlocution or synonym

Major Group	Subgroup	Strategy
Indirect Strategies		
Metacognitive Strategies	Centering your learning	Overviewing and linking with already known material
		Paying attention learning
		Delaying speech production to focus on listening
	Arranging and planning your learning	Finding out about language learning
		Organizing
		Setting goals and objectives strategies
		Identifying the purpose of a language task your learning (purposeful listening/reading/ speaking/writing
		Planning for a language task
		Seeking practice opportunities
	Evaluating your learning	Self-monitoring
		Self-evaluating
Affective Strategies	Lowering your anxiety	Using progressive relaxation, deep breathing, or meditation
		Using music
		Using laughter
	Encouraging yourself	Making positive statements
		Taking risks wisely
		Rewarding yourself
	Taking your emotional temperature	Listening to your body
		Using a checklist
		Writing a language learning diary
		Discussing your feelings with someone else
Social Strategies	Asking questions	Asking for clarification or verification
		Asking for correction
	Cooperating with others	Cooperating with peers
		Cooperating with proficient users of the new language
	Empathizing with others	Developing cultural understanding
		Becoming aware of others' thoughts and feelings

Source: Adapted from Oxford (1990, pp. 18–21)

The first is for learning a new language, which includes memory techniques for storing and retrieving new information, cognitive strategies for comprehending and developing the target language, and language usage compensatory techniques (R. L.

Oxford, 1990, p. 14). Indirect strategies, on the other hand, deal with general learning management and are classified into three subcategories: metacognitive strategies for coordinating learning, affective strategies for controlling emotions, and social strategies for interacting (R. L. Oxford, 1990, p. 15).

All four language acquisition skills, speaking, writing, listening, and reading, are addressed by Oxford's six strategies. Some strategies are applied to listening and reading, while others are used for speaking or writing or used for all four skills. In her study, she didn’t see vocabulary learning as a different skill area but as a part of four skills.

Oxford’s metacognitive strategies resemble those of O'Malley and Chamot, while her memory and cognitive strategies are similar to the cognitive strategies of O'Malley and Chamot, and her social, affective, and compensation strategies are similar to those social and affective strategies of O'Malley and Chamot.

Oxford's taxonomy of learning strategies is partially debatable. Some researchers argue that compensation strategies do not relate to learning strategies because they are related to language use strategies (Dörnyei, 2005, p. 168). Another point to consider is the distinction between memory and cognitive strategies. Memory strategies, according to Dörnyei (2005, p. 168), are a subtype of cognitive strategies, hence they do not need to be separated. From the above taxonomies, Dörnyei makes it more practical and puts learning strategies into four main categories that can be accepted mainly:

1. *Cognitive strategies*, involving the manipulation or transformation of the learning materials/input (e.g., repetition, summarizing, using images).
2. *Metacognitive strategies*, involving higher-order strategies aimed at analyzing, monitoring, evaluating, planning, and organizing one’s own learning process.
3. *Social strategies*, involving interpersonal behaviors aimed at increasing the amount of L2 communication and practice the learner undertakes (e.g., initiating interaction with native speakers, cooperating with peers).
4. *Affective strategies*, involving taking control of the emotional (affective) conditions and experiences that shape one’s subjective involvement in learning. (2005, p. 169)

These taxonomies cover all the skill domains of language learning, including listening, reading, speaking, writing, grammar, vocabulary, and translation. For the particular domain of language learning and vocabulary, however, the studies are limited.

2.1.6.2. Vocabulary Learning Strategies

One strategy to improve students' general vocabulary capacity is to teach them numerous practical vocabulary learning strategies, allowing them to become self-sufficient learners (Schmitt, 2007, p. 237). Vocabulary learning strategies, according to Gu and Johnson (1996), are methods for memorizing word lists. Consciously or unconsciously, new learners use various vocabulary learning strategies like common ones (e.g., memorization, repetition, note taking) or more complex ones (e.g., guessing, imagery, keyword, association) (Schmitt, 2007, p. 837).

According to Gu and Johnson (1996), learners' strategy choices may be shaped by either their beliefs regarding vocabulary or any other factors like social or cognitive. Schmitt claims that the deeper processing strategies may be useful for upper-level learners, but not for lower-level ones (2007, pp. 837–838). As stated by Folse (2004), there isn't any perfect specific strategy for vocabulary learning, but there are both good and bad ones. He states that good learners know how to choose strategies that are personally convenient for themselves.

Vocabulary learning strategies should respond to different aspects of word knowledge. According to Gu (2003), the primary purpose of vocabulary acquisition is to retain the words and be able to utilize them in a variety of situations. Hence, knowing a word and how to use it should be part of vocabulary learning strategies.

There are several taxonomies of vocabulary acquisition tactics or strategies, albeit they are not as many as other strategies of language learning.

Oxford & Crookall (1990) classified a variety of techniques, which are used, misused, or ignored by second or foreign language teachers, into four groups: (1) decontextualizing techniques, which are isolating L2 words from any meaningful context that helps learners get any clue about their meaning, (2) semi-contextualizing techniques, which offer limited context, thereby comprehension is not always possible, (3) fully contextualizing techniques where the new words are presented in a communicative context, thereby learners' comprehension is boosted, and (4) adaptable techniques, which strengthen the other three techniques. The Majority of those techniques, presented in Table 3, overlap each other (R. Oxford & Crookall, 1990). Visual imaging and semantic mapping, for example, have a same theoretical and practical foundation.

Table 3: Oxford and Crookall's Taxonomy of Vocabulary Learning Techniques

Technique Group	Technique
Decontextualizing	Word Lists
	Flashcards
	Dictionary use
Semi-Contextualizing	Word Grouping
	Word or concept association
	Visual imagery
	Aural imagery
	Keyword
	Physical response
	Physical sensation
	Semantic mapping
Fully Contextualizing	Reading and Listening Practice
	Speaking and Writing Practice
Adaptable	Structured Reviewing

Source: Adapted from Oxford & Crookall (1990)

Gu and Johnson (1996) proposed another taxonomy of vocabulary learning strategies based on self-reported vocabulary learning strategies collected from Chinese college students. In the vocabulary learning strategies questionary, which includes 91 items that refer to vocabulary learning behaviors, they separated them into two major groups named metacognitive regulations and cognitive strategies. Table 4 shows these strategies in more detail.

Table 4: Gu and Johnson's Taxonomy of Vocabulary Learning Strategies

Strategy Major Group	Strategy Subgroup	Strategy
Metacognitive regulation	Selective attention	
	Self-initiation	
Cognitive	Guessing	Wider context
		Immediate context
	Dictionary	Comprehension
		Extended dictionary
		Looking-up
	Note-taking	Meaning-oriented notetaking
		Usage-oriented note taking
	Rehearsal	Using word lists
		Oral repetition
		Visual repetition
	Encoding	Association/elaboration
		Imagery
		Auditory encoding
		Using word-structure
		Semantic encoding
		Contextual encoding
	Activation	

Source: Adapted from Gu and Johnson (1996)

Schmitt (1997) offers another taxonomy of vocabulary learning strategies that consists of 58 vocabulary learning strategies divided into five categories. They include the strategies that help both discover a newly encountered word's meaning and consolidate it:

1. *Determination strategies* that are used for discovering the meaning of a new word upon encountering (e.g., analyzing, guessing, using a dictionary).
2. *Social strategies* consisting of interaction with other people to enhance learning (e.g., peer working, getting help from a teacher, interacting with a native speaker of the target language).
3. *Memory strategies* connecting new words with previous knowledge (e.g., use of semantic maps, use of keyword technique, use of associating technique),

4. *Cognitive strategies* manipulating the data concerning newly encountered words (e.g., keeping a notebook, labelling physical objects, writing repetition), and
5. *Metacognitive strategies* that are organizing vocabulary learning process (e.g., structured rehearsal, taking word tests, maintaining the study of words over time).

This taxonomy was compiled from the strategies gathered from multiple sources (Japanese students, teachers, books, textbooks). Schmitt (1997) made use of Oxford's social, memory, cognitive, and metacognitive strategies and included the strategies of determination to identify strategies that a learner uses when encountering an unfamiliar word without applying to someone else's knowledge. Some of the social strategies that ask the teacher for help in getting meaning and get meaning through group work are used for either discovering or consolidating an encountered word. Table 5 shows the details of the taxonomy offered by Schmitt (1997) for vocabulary learning strategies.

Table 5: Schmitt's Taxonomy of Vocabulary Learning Strategies

Strategy Group	Strategy
Strategies for Discovering the Meaning of the New Word	
Determination	Analyze part of speech
	Analyze affixes and roots
	Check for L1 cognate
	Analyze any available pictures or gestures
	Guess from textual context
	Bilingual dictionary
	Monolingual dictionary
	Word lists
	Flash cards
Social	Ask teacher for an L1 translation
	Ask teacher for paraphrase or synonym of new word
	Ask teacher for a sentence including the new word
	Ask classmates for meaning
	Discover new meaning through group work activity

Strategy Group	Strategy
Strategies for Consolidating a Newly Encountered Word	
Social	Study and practice meaning in a group
	Teacher checks students' flash cards or word lists for accuracy
	Interact with native speakers
Memory	Study word with a pictorial representation of its meaning
	Image word's meaning
	Connect word to a personal experience
	Associate the word with its coordinates
	Connect the word to its synonyms and antonyms
	Use Semantic maps
	Use 'scales' for gradable adjectives
	Peg Method
	Loci Method
	Group words together to study them
	Group words together spatially on a page
	Use new word in sentences
	Group words together within a storyline
	Study the spelling of a word
	Study the sound of a word
	Say new word aloud when studying
	Image word form
	Underline initial letter of the word
	Configuration
	Use Keyword Method
	Affixes and Roots (remembering)
	Part of Speech (remembering)
	Paraphrase the words meaning
	Use cognates in study
	Learn the words of an idiom together
	Use Physical action when learning a word
	Use semantic feature grids
Cognitive	Verbal repetition
	Written Repetition
	Word Lists
	Flash Cards
	Take notes in class
	Use the vocabulary section in your textbook
	Listen to tape of word lists
	Put English labels on physical objects
	Keep a vocabulary notebook
Metacognitive	Use English language media (e.g., movies, songs, newscasts)
	Testing oneself with word tests
	Use spaced word practice
	Skip or pass new word
	Continue to study word over time

Source: Adapted from Schmitt (1997)

Cohen, Oxford, and Chi (2005) offer a more practical inventory for learners and teachers to assess their learning strategies. Their skill-based inventory includes listening strategy use, speaking strategy use, reading strategy use, writing strategy use, vocabulary strategy use, and translation strategy use. Each part has different items. The vocabulary strategy use subscale covers 18 items in total, four categories: strategies to learn new words, strategies to review vocabulary, strategies to recall vocabulary, and strategies to make use of new vocabulary.

Tseng, Dörnyei, and Schmitt (2006) offer a new approach to strategic learning through the self-regulation approach, which emphasizes the learners' innate self-regulatory capacity that enables them to select a convenient strategy to use rather than strategic use. The system they created, the Self-Regulating Capacity in Vocabulary Learning Scale (SRCVOC), concentrates on five extensive facets of self-regulation in vocabulary learning and includes a total of 45 items:

1. *Commitment control* aids in sustaining or boosting the learners' goal dedication.
2. *Metacognitive control* includes monitoring, controlling concentration, and blocking any pointless delays.
3. *Satiation control* helps to discard boredom and increase interest in the task.
4. *Emotion control* deals with the management of bad moods or emotional states.
5. *Environmental control* aids in increasing the quality of the environment.

Sarıçoban (2018, p. 129) categorizes the techniques of vocabulary teaching under six groups: visual techniques, verbal techniques, translation technique, dictionary definition technique, code-switching technique, and guessing from context technique. Table 6 shows the details of the taxonomy of the techniques that Sarıçoban (2018, p. 129) used for vocabulary instruction.

Table 6: Sarıçoban's Taxonomy of Vocabulary Learning Techniques

Technique group	Technique
Visual Techniques	Flash cards
	Photographs
	Wall charts
	Realia
	Mine
	Gestures
Verbal techniques	Dialogues
	Stories
	Sentences
	Illustrative situations
	Synonyms
	Antonyms
Translation technique	
Dictionary technique	
Code-switching technique	
Guessing from context technique	

Source: Adapted from Sarıçoban (2018)

According to Sarıçoban (2018), the proficiency level of learning necessitates the use of different techniques. For instance, for beginner picture flash cards, explanation in L1, simple definition in L2 with words studied, commands, real objects, and drawing are techniques for introducing new words' meanings.

The researchers indicate how important vocabulary is for SLA, but how much vocabulary learning should be is a controversy. The context of learning, individual differences, beliefs, proficiency level of learners, awareness of teachers and learners, materials, etc. play an important role in the choices and use of any strategies or techniques mentioned above. For that reason, teachers should consider this diversity and use and teach a variety of those techniques. In the era of communicative teaching, one of the tasks of teachers is to provide necessary strategies for their students, so they can sustain their own learning and, thereby, eventually become autonomous learners (Brown, 2000; Dörnyei, 2005; R. L. Oxford, 1990; Schmitt, 2007).

Another important issue about vocabulary instruction is whether it should be explicitly or implicitly taught, which is the topic of the next section.

2.2. Explicit Vocabulary Learning Versus Implicit Vocabulary Learning

The terms of "explicit" and "implicit" have various definitions. However, simply put, explicit learning is "conscious awareness and intention" while implicit learning is "learning without conscious attention or awareness" and both terms are used as synonyms for intentional and incidental learning (Brown, 2007, p. 291). In SLA, both approaches are arguable. Implicit or incidental vocabulary learning is associated with reading and listening. Krashen (1982, p. 81) claims that direct or explicit vocabulary instruction is unnecessary and that vocabulary learning depends on sufficient comprehensible input through pleasure reading, by means of which ultimately vocabulary learning takes place. He believes that comprehensive input provides a new word in frequency and gets learners to acquire its meaning in this way. Is this really enough for vocabulary learning, especially in EFL contexts?

However, other scholars (Brown, 2007; Dörnyei, 2009; Ellis, 1994; Laufer, 2003; Sarıçoban, 2018; Schmitt, 2007; Ur, 2012) think differently. Gu (2003) argues that in an EFL context where natural language input is lack or very limited and lacking of reading material makes implicit or incidental vocabulary learning difficult. He states that a mutual approach is superior to incidental learning on its own. According to Ellis (1994, p. 643), explicit learning is the most effective for presenting rules by supporting them with examples, and both the linguistic material that is to be learned and the learners' characteristics may determine the effectiveness of explicit or implicit learning. This is supported by Dörnyei (2009, p. 270) by arguing that implicit learning may work for someone to reach a native speaking proficiency level in their first language, but does not work well in SLA. SLA cannot be achieved only through simple exposure to natural input of L2 for many students.

Schmitt (2007, p. 833) states that any specific vocabulary learning method does not sufficiently itself to be useful to respond to all the aspects of word knowledge. He argues that vocabulary learning should include both explicit and implicit learning. He explains that while some aspects of word knowledge like grammatical characteristics and meaning, can be given explicitly, other aspects such as collocation, register, and intuitions of frequency can be learned implicitly through extensive exposure to the target language in various contexts (e.g., classroom activities, reading, and being in one of English-speaking countries for a certain time) (2007, pp. 833–834). Schmitt (2007, pp. 834–837) entitles the intentional learning of vocabulary as studying word pairs, groups of words as well as cross-associations, contextual meaning, word families, word parts (e.g., affixes, prefixes), and sequences of words. He claims that learners can master much of the vocabulary autonomously if they know various vocabulary learning strategies that can be taught by their teachers (2007, p. 837).

The stock of vocabulary is so extensive that teaching or learning is not easy and cost-effective for both teachers and learners to take place explicitly with limited classroom hours. Hence, some aspects of vocabulary learning may be conducted explicitly while others may take place implicitly. There are actually a variety of aspects of learning, such as individual differences, availability of materials, learners' proficiency level, context of learning, etc. that have an effect on the choice of either learning. As Dörnyei (2009, p. 272) states, explicit learning cannot be excluded from the theory of SLA, but it does not mean that it should take the place of implicit learning. Instead, the aim should be how to improve the cooperation between them. Technological advancement offers this chance to teachers. The next section deals with one of the methods that provide a different approach to language learning, and so does vocabulary learning.

2.3. Computer Assisted Language Learning (CALL)

With its introduction, the computer plays an important role in all aspects of life. It is not possible to find a place without it. One of those areas mainly used is education. By offering a proactive environment, they become attractive for both teachers and students. It is seen as such a practical and useful tool that it becomes a sort of learning, named "CALL," in time. Levy (1997, p. 1) defined it as “the search for and study of applications of the computer in language teaching and learning”. According to Hubbard (2021, p. 1), it is “any endeavor involving the use of computers and associated technologies of all types - desktops, laptops, tablets, smart phones, mp3 players, interactive whiteboards, etc. - in some significant way in language learning and teaching”. It may sometimes be named as CELL (Computer-Enhanced Language Learning), TELL (Technology-Enhanced Language Learning), TALL (Technology-Assisted Language Learning), or CALI (Computer-Assisted Language Instruction). CALL goes back to the 1960s, the beginning of the development of the system of PLATO, which refers to Programmed Logic for Automatic Teaching Operations, aimed to teach different subjects as well as foreign languages through providing drill and practicing materials (Levy, 1997, pp. 15–18). The developments in computer technology, such as multimedia, WWW (World Wide Web), internet connection, email services, and applications (e.g., word processors, spreadsheets), mobile technologies, are increasing its attraction and productivity day by day.

CALL does not have any dedicated theory but includes a variety of theories such as SLA, human-computer interaction, linguistics, learning, and so on (Hubbard, 2021). It includes all language learning skills-listening, reading, speaking, writing, translation, and vocabulary. The multimedia support, internet connection, and applications offer a more interactive and more motivating environment for both teachers and learners. In order to make use of CALL, the training of both teachers and students is a very important aspect of CALL. With the different educational methods, they should be trained on how to use those tools that are part of CALL. It should be gradually incorporated into the curriculums of all levels of learners (Seljan, Berger, & Dovedan, 2004). Online learning, computer-based assessments, mobile assisted language learning, and virtual technologies are some current trends in CALL (Hubbard, 2021, p. 12). The study is to continue with mobile assisted language learning (MALL).

2.4. Mobile Assisted Language Learning (MALL)

Rapid developments in information technologies have changed traditional language learning and led to the emergence of the m-learning. Geddes (2004) defines m-learning as the process of learning and gaining a skill with a mobile device “anywhere anytime”. Learning is no longer just confined to the classroom and guided only by teachers. It becomes autonomous. Students can self-direct their learning process. M-learning breaks the boundaries of traditional learning, and so does the teaching of English as a second language (ESL) and English as a foreign language (EFL). So, the term MALL (Mobile Assisted Language Learning) emerged.

Nowadays, it is so popular that there are numerous mobile apps on the market that are used by both teachers and students, or those trying to learn English or any other language. According to new research, in 2020, there were over 500.000 educational apps on the markets such as Google Play, Apple Store, and Windows, and this number increases every day (Riley, 2021).

Several studies (Agca & Özdemir, 2013; Alemi, Sarab, & Lari, 2012; Basal, Yilmaz, Tanriverdi, & Sari, 2016; Castrillo, Martín-Monje, & Bárcena, 2014; Hayati, Jalilifar, & Mashhadi, 2013; Jalalifarahani & Ghovehnodoushan, 2011; Lawrence, 2014; Lu, 2008; Stockwell, 2010; Suwantarathip & Orawiwatnakul, 2015; Thornton & Houser, 2005; Y. H. Wang & Shih, 2015; Zhang, Song, & Burston, 2011) show that teachers and students have positive attitudes towards mobile language learning. Steel describes this as:

> Mobile apps are beneficial because you can access them anywhere, meaning you are more effective with your time. Successful language learning occurs mainly in immersive type environments, so I think that mobile apps are most beneficial because they bring more exposure and engagement with the language than just the time spent in the classroom. (2012, p. 880)

There is even research that indicates the superiority of MALL. Research by Basoglu and Akdemir (2010) shows that mobile-supported vocabulary instruction is superior to the traditional methods. The next section of the study is to detail the research regarding vocabulary learning.

2.5. MALL and Vocabulary Instruction

With the development of mobile technology, many L2 learners make use of mobile devices, especially phones and tablets, to enhance their language skills, one aspect of which is vocabulary learning. There are a variety of studies related to how L2 learners make use of them. One common property of a mobile device is the short message service (SMS). This SMS ability has become the subject of several studies to see if it is a useful tool for vocabulary instruction or not.

Lu (2008) explored the effects of SMS-based vocabulary learning on thirty high school students randomly selected. The study is based on qualitative research and data gathered through interviews and questionnaires. The results indicate that the students generally have positive attitudes towards m-based vocabulary learning, while some distractors, such as technical constraints and study activities, could stop students from taking SMS lessons.

Jalalifarahani and Ghovehnodoushan (2011) explored the efficiency of vocabulary learning through SMS. The study includes fifty-five elementary students in Taft, Iran. The experimental group used the mobile devices to receive three words with their meaning in English and Persian three times a day through SMS, while the control group conducted realia-based vocabulary learning. The results of the experiment showed not only the effectiveness of SMS-based vocabulary learning over the realia-based vocabulary learning but also a high motivation for the students.

Zhang et al. (2011) also studied the effectiveness of vocabulary learning via mobile phones. The study included seventy-eight university students and the data was collected via tests and students' reports. The results of the study showed that vocabulary learning is practical via mobile phones, but effectiveness depends on repetition. Mobile phone technology is essential for the vocabulary instruction, yet it can be more effective through a blended learning approach.

Alemi et al. (2012) explored the effects of SMS-based vocabulary learning. The study, including forty-five university freshman students, to study academic vocabulary showed that the experimental group using SMS messages didn't make a big difference. The results also showed that SMS-based vocabulary learning is useful for students to retain words in their long-term memory.

Hayati et al. (2013) compared SMS-based idiom learning to both contextualized learning and self-study learning. The study covered 60 Persian learners of English. The SMS-based study group was sent four short messages, including four idioms with meaning and usage in the sentences, while the contextualized learning group got the same idioms in the classroom, and the self-study group took their study of the idioms through the paper with definitions and examples. The results revealed that the students of SMS-based learning learned more and were more eager than both those who did contextual-based learning and self-study learning.

Suwantarathip and Orawiwatnakul (2015) found SMS-supported vocabulary learning has a significant impact on students' vocabulary capacity in the study, which involved eighty students in a university in Thailand. The study group that used SMS outside the classroom for exercises did better than those who used paper-based exercises in the classroom.

The above all SMS-based vocabulary learning studies confirm the students' good attitudes regarding the use of SMS in order to learn vocabulary and its effectiveness.

Another property of a mobile device is the multimedia messaging service (MMS). Some researchers also use this method for vocabulary learning. The following studies show this:

Saran et al. (2012) studied to see how successful multimedia messages sent via mobile phones are in helping language learners consolidate their vocabulary. The research comprised students from an English-medium institution in Turkey's English Preparatory School. The definitions of terms, sample sentences, relevant graphic representations, information on word creation, and word pronunciations were all included in the MMS messages in this study. The quantitative data demonstrated that students' vocabulary acquisition was aided by utilizing mobile phones, which allowed them to recontextualize, recycle, and consolidate their vocabulary.

Besides SMS and MMS, Thornton and Houser (2005) conducted studies on the effectiveness of e-mails on mobile phones on vocabulary instruction. They carried out three different tasks. The first one is a pool on the use of mobile devices, including 333 female university students in Japan. The pool results showed that almost all the students owned and regularly used their mobile phones. The e-mail functions of the phones were more commonly used by the students, but they were not good at using the Web and other features of the phones. In the second experiment, forty-four students got one-hundred-word English vocabulary lessons through e-mail. The experimental group did better than the controlled group when using paper-based materials. The majority of the experimental group possessed a positive attitude towards email-based vocabulary learning. The last experiment related to the students' attitudes towards video and Web materials via mobile phones and PDAs. Students assess the website (Vidioms) aimed at teaching idioms that were defined and exemplified via sounds, images, and videos. The assessment results showed that the students liked the use of the website, including multimedia on the mobile devices.

Another teaching medium used just like SMS, MMS, and e-mail is WhatsApp. It is mostly used on mobile devices and works on a variety of platforms including Android, iOS, Windows, and Linux. The software allows users to send text and voice messages, have audio and video conversations, and share photos, documents, user locations, and other information. With these skills, WhatsApp is one of the most popular apps owned by many users, including teachers and students. Thus, it has been used as a teaching tool as well. The studies cited in the following paragraphs explore its effectiveness as a language learning tool.

Plana et al. (2013) investigated if WhatsApp may be a good tool for improving learners' reading abilities in an EFL environment. The study included ninety-five university students in Catalonia. The comprehension texts were sent to the WhatsApp group, and students answered and checked their results after reading. The results of the survey that was done after twelve weeks showed a positive effect of the method on students and helped them increase their reading skills.

Alsaleem (2013) studied the effectiveness of WhatsApp dialogue journaling on university English students' writing skills in Saudi Arabia. The students were asked to comment on different topics on their WhatsApp group. After the six-week experiment, the test results of the thirty students showed quite an enhancement in their writing skills in terms of word choice and voice.

Lawrence (2014) had a case study as well. He used WhatsApp as a medium of teaching to explore if the students could enhance their vocabulary by getting the messages supported by images and sounds. The seven-week study included five undergraduate students in Africa. During the first five weeks, the WhatsApp group of the students received the words with sounds and images, and in the last two weeks, they got phrases and full sentences as well. The results of a seven-week experiment whose data was gathered from the questionnaires showed that WhatsApp had great potential for the development of the vocabulary size of the learners of EFL if the contents of the messages were well arranged. It also demonstrated the students' positive attitude towards MALL.

Castrillo et al. (2014) explored the effectiveness of WhatsApp-based discussion for meaning negotiation between learners of EFL. The participants were eighty-five students of the German course in Distance Learning at the National University of Distance Education in Spain. The students were divided into five WhatsApp groups, and the groups discussed the texts sent to them during the six weeks. The results of the quantitative and qualitative data showed that the use of WhatsApp for EFL is useful as it not only enhances the students' discussion skills, thereby exposing them to the language, but also reduces the students' errors and creates motivation for students as well.

Basal et all. (2016) studied the effectiveness of the WhatsApp application in vocabulary instruction. The four-week study, including fifty new university beginner students, compared the scores of students learning idioms through the MMS messages received from WhatsApp to those learning through paper. The experimental group used MMS messages to receive the images and texts for studying forty figurative idioms from the Michigan Corpus of Academic Spoken English (MICASE), while the control group studied the same idioms through traditional activities. The data results showed that the experimental group using mobile applications to get MMS messages outperformed the control group using classical teaching activities for learning the idioms.

Taj et all. (2017) explored the effect of technology-enhanced language learning on the vocabulary learning of EFL learners. One hundred twenty-two new university beginners participated in the study, which lasted six weeks. The experimental group received the word cards taken from the course book through WhatsApp and studied the vocabulary quizzes and word puzzles created by free software on computers in the language lab and on CDs at home. According to the results of the hybrid model constructed using computer and mobile phone technologies, on the posttest, in comparison to the control group, the experimental group outperformed it.

There are also a great number of these apps on various platforms like Android, IOS, and Windows, all developed for direct language learning. They seem more practical than the abovementioned tools in terms of autonomous learning.

One of these examples, related to mobile-based vocabulary instruction, was studied by Basoglu and Akdemir (2010). The study, which involved sixty new beginners at a university in Turkey, aimed to show the effectiveness of mobile apps on vocabulary learning. The experimental group used the mobile app (the ECTACO Flash Cards with only the text feature) on their phones for studying a specified vocabulary list, whereas the control group studied the same vocabulary list via the paper-based flashcards. The findings revealed that the two groups did not differ significantly. In the multiple-choice post-test, however, the experimental group, which utilized the mobile app, outperformed. The experiment confirmed the effectiveness of mobile-app-based vocabulary learning.

Stockwell (2010) executed a three-year experiment to explore the effects of the use of mobile phones and the use of computers on vocabulary learning. An app called VocabTutor is embedded into the Moddle program used for this study. The study focused on the learners' scores, the time spent on each platform, and longitudinal patterns. The findings revealed that there was no consistent difference in learners' scores between those who used mobile phones and those who used PCs. The second result of the experiment showed that, though the reason was not clear, the users of mobile phones spent more time completing the tasks than the computer users. Lastly, the study demonstrated the platforms did not increase the users' speeds and scores. However, it showed that the learners' preference to using mobile phones since 2009 has increased.

Agca and Özdemir (2013) studied the effectiveness of mobile app-supported vocabulary learning lessons. The study involved forty students from Gazi University in Turkey. The participants used both the course book and the app with features like images, meanings, and examples of the same words from the course book during the two weeks in the classroom. The results of the tests showed the participants enhanced their vocabulary considerably and the use of the mobile app creates motivation for the learners of EFL.

Wang and Shih (2015) explored the effectiveness of a mobile-based vocabulary learning program. The study covered ninety-three Taiwanese college students. For fifteen weeks, the experimental group studied vocabulary through the mobile app while the control group did paper-based vocabulary instruction. According to the results, the experimental group, in comparison to the control group, outperformed and had more positive opinions toward mobile-based vocabulary acquisition.

Wu (2015) developed a mobile phone app which is called Word Learning-CET4 and had 3402 English words with text, spelling, pronunciation, and Chinese explanations to test the effectiveness of it. An experiment with one hundred and one experimental students and ninety-eight control students was conducted at Jiujiang University in China. The app-using experimental group, when compared to the paper-based study group, outperformed, which thus showed the effectiveness of the mobile phone app for the learners of L2. The app enabled the users to retain 8.49% more words than the control group who did paper-based study in the classrooms.

Ahmad et all. (2015) explored the experiences of six non-native English-speaking migrant women's mobile-based vocabulary learning in Australia. The group used the app called ThinkEnglish! with the features of videos, sound, pictures, and text on the tablets to study language learning. The study's results revealed that the mobile app-based learning enhanced the participants' vocabulary acquisition and motivation.

Suwanthep and Wang (2019) investigate the effects of vocabulary learning through the constructivism-based developed mobile application and students' attitudes towards vocabulary learning through the constructivism-based developed mobile application. Twenty university students took part in the study, which was split into two groups: experimental and control. Two groups attended the class and got the same words defined before. While the experimental group previews the words through the mobile app with the features of pronunciation, sound, related pictures, example sentences, Thai meaning, and English definitions in the preview part, the other group used the dictionary. After the class, the experimental group first used the mobile app to do their first review, and one week later, they did their second review, while the control group reviewed the same word list through paper-based learning. The test results showed not only the constructivism-based vocabulary learning through the mobile app enhanced the learners' vocabulary capacity and retention, but also the mobile app was well-liked by the students.

Majority of the above-mentioned studies aimed to MALL by using different features of the mobile devices such as SMS, MMS, or a short message app like

WhatsApp, but only a few of them were directly developed as an app of MALL. Therefore, it is very important to study more on the apps that are only developed for MALL, especially in the countries like Turkey where English is learned as a foreign language mainly in formal settings with limited class hours. According to the studies, MALL not only motivates language learners but also aids in the learning process that begins in the classroom and continues outside of it. In order to continue this learning process, the guidance of teachers is paramount for students to make use of proper apps of MALL. As Harmer (2007, p. 107) states, teachers are the creators of autonomous learning, in which students take their own responsibilities for learning. The study by Qian and Tang (2018) confirms this support. It reveals that the majority of students in the research need their teachers' support for appropriate use of MALL. As it is stated by Hoi and Mu (2021), teachers play a critical role in shaping students' behaviors through the use of mobile-assisted language learning both in the classrooms and outside classrooms.

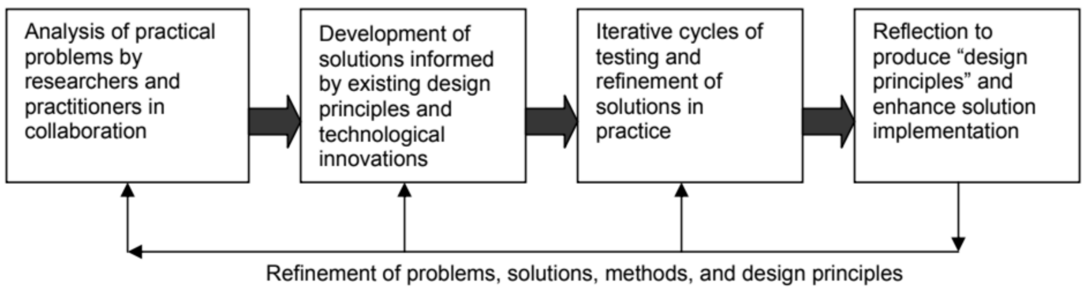
This study aims to provide a direct mobile app for vocabulary learning that allows students to learn English vocabulary outside of class at anywhere and anytime without any cost. The worDBook app uses multimedia (speech and images) to improve retention and make learning more appealing to students.

CHAPTER 3 - METHODOLOGY

There have been many smart phone or tablet users who make use of these mobile devices not only for entertaining but also for gaining different skills, one of which is vocabulary learning. This study suggests a mobile assisted vocabulary learning application. In order to meet this demand, this study aims to use the Design-Based Research (DBR) methodology, whose characteristics are defined by Wang and Hannafin as "a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (2005, p. 6).

The process of DBR involves analysis, design, evaluation, and revision which continues until meeting the requirements. The phases of the process are depicted at Figure 1.

Figure 1: The Four Phases of Design-Based Research



Source: Amiel and Reeves (2008, p. 34).

3.1. Analysis of the Problems

Turkey, a country that aims to join the European Union, places more importance on ELT in almost all educational institutions. Considering the number of resources allocated for this issue, it is not difficult to understand how important it is for the country.

One of the essential parts of language learning is vocabulary. As clearly stated before, in a language nothing can be conveyed without vocabulary (Wilkins, 1972, as cited in Sarıçoban, 2018, p. 124). As well known, Turkey is not an English-speaking country, English is learned as a foreign language as well as teachers try to have the students gain more vocabulary at school, but this effort is not enough without lasting study outside of school. At this point, mobile-based vocabulary learning can be a useful option for both teachers and students for effective vocabulary instruction.

In order to meet this requirement, a direct mobile app with the use of multimedia (speech and image) is required to enhance the retention and be attractive to learners for vocabulary learning outside class and be used anywhere and anytime without any cost. The words included in the app should correspond to the curriculum of the school in order to be effective for vocabulary acquisition.

As the age and level of learners are considered, the abovementioned techniques of grouping, presenting written and oral form, visual encoding, L1 meaning, and repetition are effective for vocabulary teaching and learning for beginners. As a result, those techniques will be included in the worDBook mobile application, which aims to teach vocabulary. The app includes the activities of study and practice. Thus, the user is to learn the word's written and speech form, L1 meaning, and usage with a model sentence. The interaction of the learning process via this app that facilitates learning is to include learner-content interaction and learner-device interaction. The next section explains how to implement this interaction and the development of the application.

3.2. Development of the System

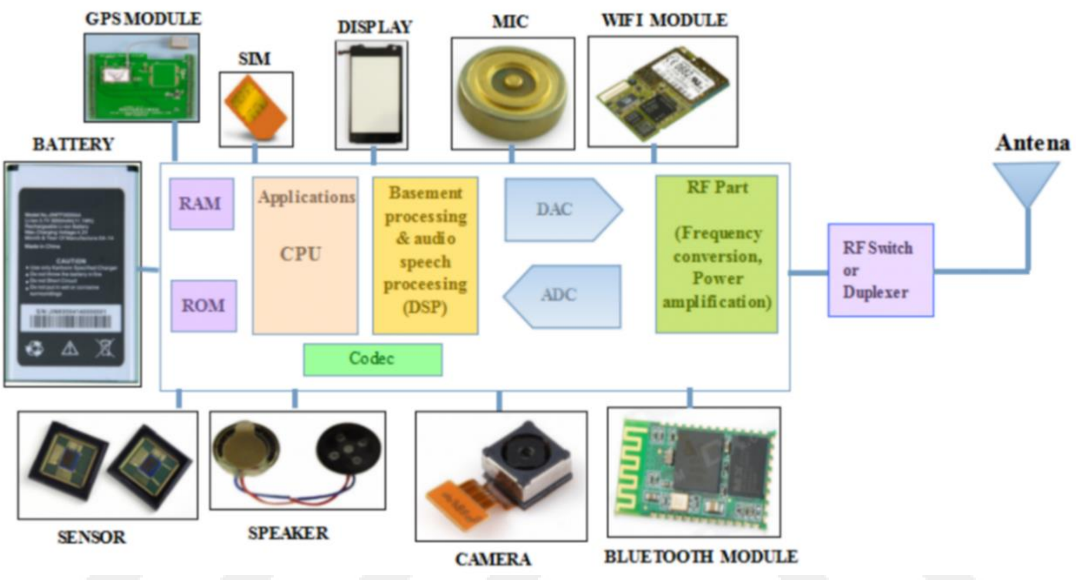
Mobile learning has three components: the mobile device, the user, and the content. There is interaction among them. Based on the sorts of mobile devices used, such as portable computers, MP3 players, laptops, mobile phones, and tablets, this interaction is subject to change. These mobile devices have different architectures and thus run on different operating systems that run different applications on them. Next is to focus on the mobile information system.

3.2.1. Mobile Information System

3.2.1.1. Mobile Phone Architecture

Mobile devices combine the features of a PC with the features of the common essential mobile systems, like a wireless inbuilt modem and a SIM tray for telephony and data connection. Figure 2 depicts a general mobile phone architecture. It has a touch-sensitive display, a digital or tangible keypad, a speaker set, a microphone, a camera(s), Bluetooth, GPS, Wi-Fi, a USB port, RAM, ROM, a CPU that runs applications, codec, sensor, antenna, ADC (Analog to Digital Converter), DAC (Digital to Analog Converter), RF Switch/Duplexer, and a battery.

Figure 2: Mobile Phone Architecture



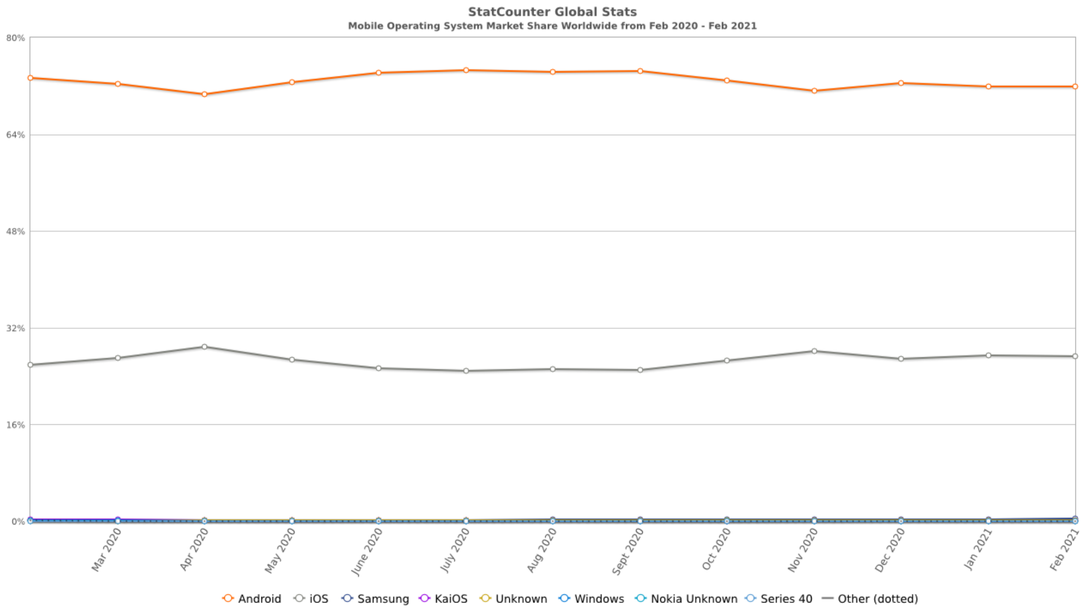
Source: (“Mobile Phone Architecture,” 2015)

3.2.1.2. Mobile Operating System

According to Kumtepe et al. (2015, p. 5), an operating system is a general software that regulates and manages the resources of hardware and software that are integrated into the computer system rapidly, effectively, and safely between the users. This structure, which works on personal devices such as phones, tablets, and watches, is also defined as a mobile operating system.

There are many types of mobile series on the market, and their most frequently selected ones are presented in Figure 3. The figures show that Android is the most commonly preferred operating system, which is the reason for this app's being developed on it.

Figure 3: Global Mobile OS Market Share between 2009 and 2018

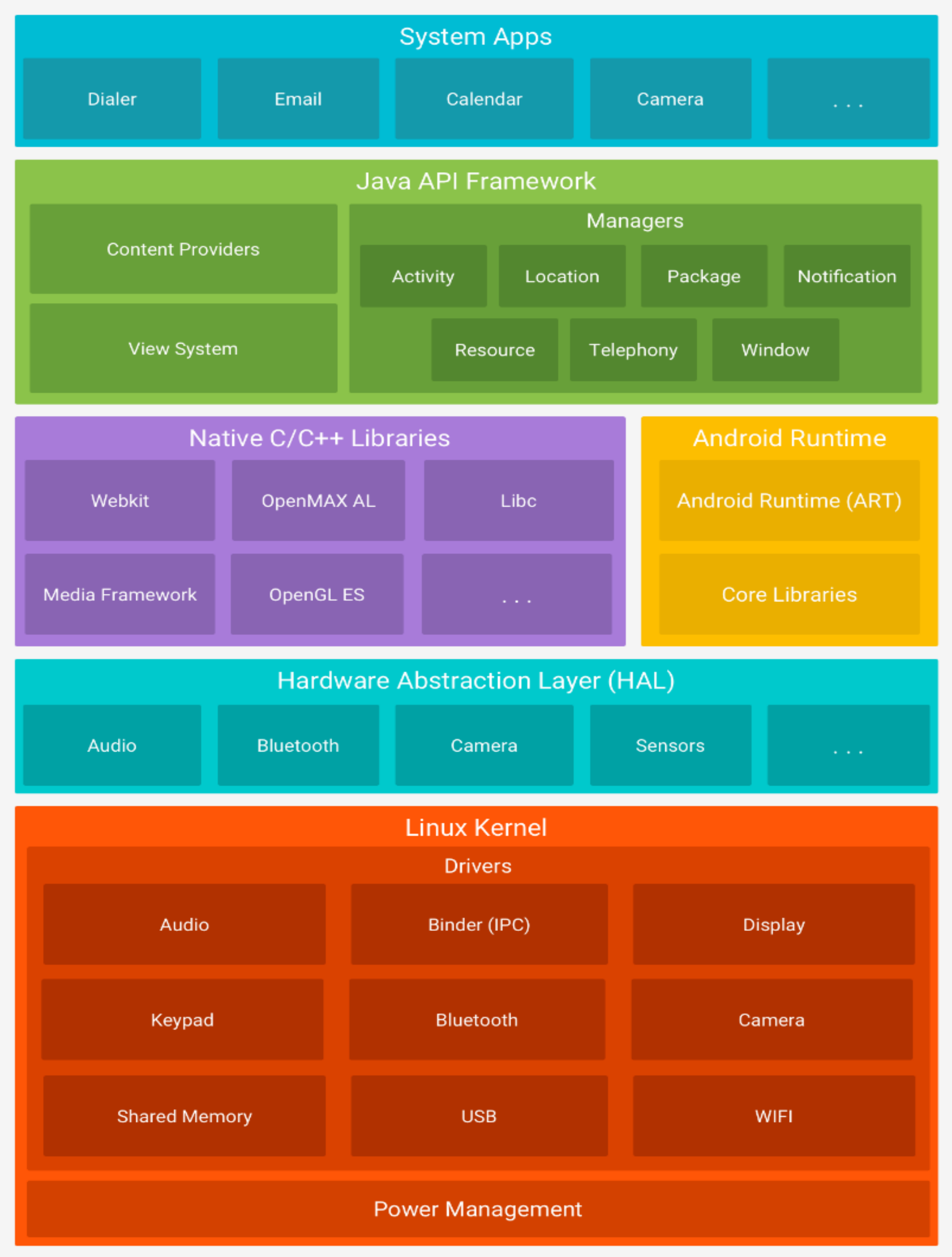


Source: ("Mobile Operating System Market Share Worldwide," 2021)

Android is an open-source mobile operating system that was created by Google as part of the open-source Linux project. The company released the first version in 2007.

Figure 4 depicts the Android architecture. The system includes a Linux kernel in the first layer, a Hardware Abstraction Layer (HAL) in the second layer, Native C/C++ Libraries and Android Runtime in the third layer, the Java API Framework in the fourth layer, and System Apps in the fifth layer ("Platform Architecture," 2021).

Figure 4: Android System Architecture



Source: ("Platform Architecture," 2021)

The Linux Kernel layer ensures that mobile hardware components will be used effectively by the Android Runtime. This core also allows mobile device manufacturers to develop hardware drivers ("Platform Architecture," 2021).

The Hardware Abstraction Layer (HAL) in the second layer provides a standard interface between the hardware and the Java API Framework that exists at the top layer. When the framework makes the relevant hardware request, the Android system provides the library module for the relevant piece of hardware (“Platform Architecture,” 2021).

The Native C/C++ Libraries section in the third layer allows the application to use some functions of the libraries needed by Android system components, such as HAL and Java framework APIs. The Android runtime section contains the basic libraries that applications need and the section where the Dalvik Virtual Machine (DVM) runs (“Platform Architecture,” 2021).

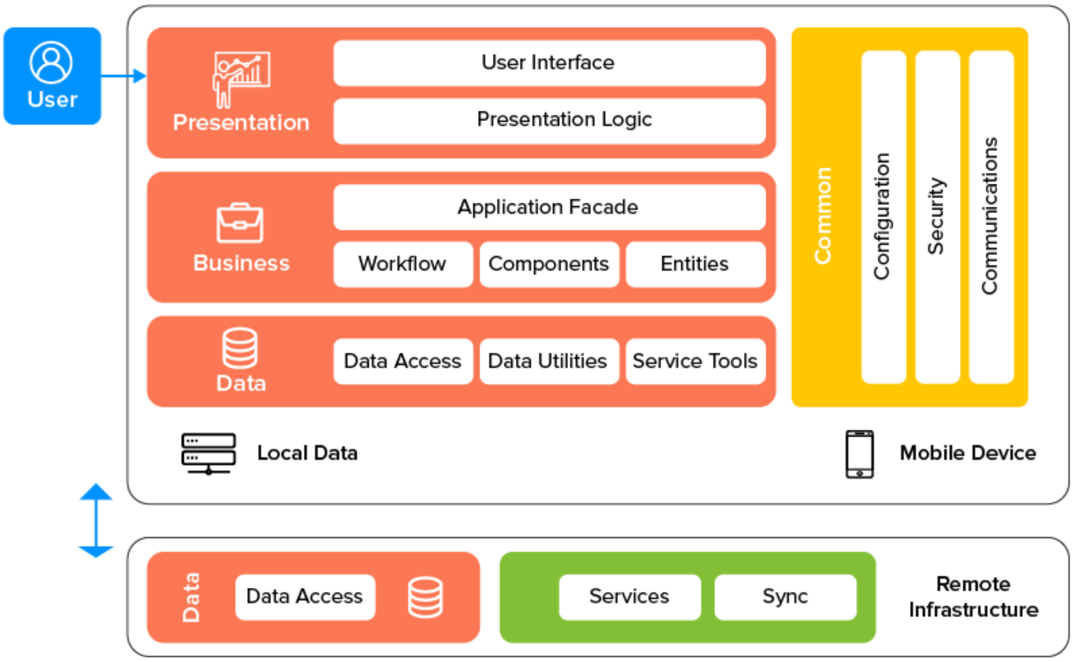
The Java API Framework in the fourth layer provides access to all the resources and services that applications need. The system allows developers to access these Java Framework APIs, such as Android applications (“Platform Architecture,” 2021).

Found in the fifth layer, System Apps is the layer in which the operating system runs many basic applications such as E-mail, SMS, calendar, keyboard, and applications created by other developers (“Platform Architecture,” 2021).

3.2.1.3. Mobile Application

A mobile application, sometimes referred to as a phone app or just an app, is software or a computer program designed to run on a mobile device such as a phone, tablet, or watch. A common architecture of a mobile app is shown in Figure 5.

Figure 5: A Common Mobile Application Architecture

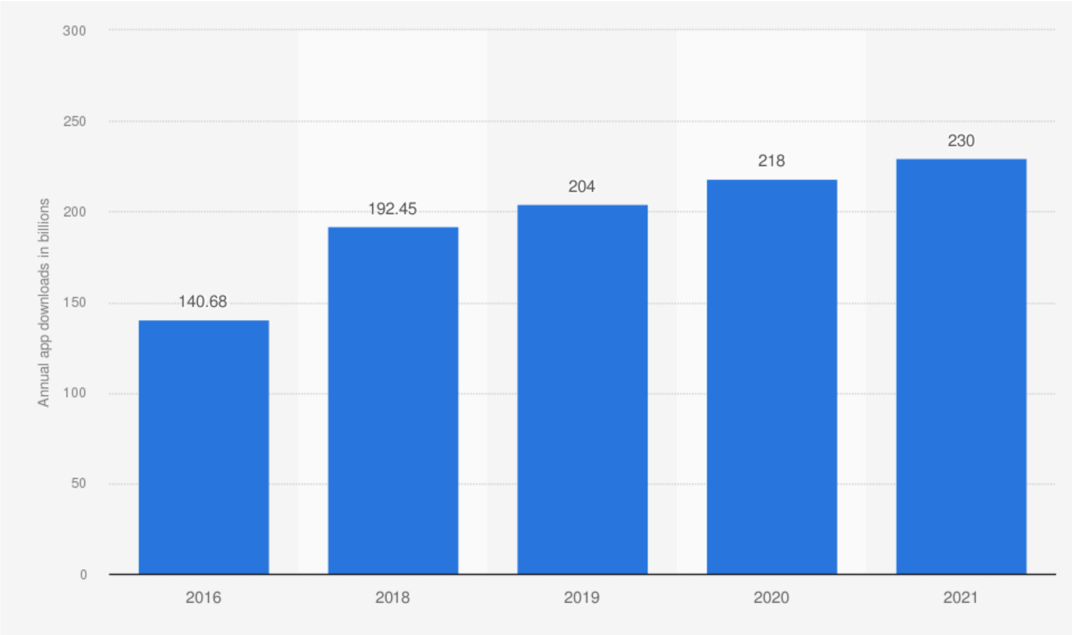


Source: ("Mobile App Architecture -How to Design It?," 2020).

Presentation, business, and data are three main layers of the mobile app architecture that play important logic in developing mobile applications. The presentation layer includes both the user interface (UI) and its process. The app's themes and styles are presented in this layer. The UI plays an important role in creating an interaction between the user and the app. Thus, it should be not only simple but also attractive. The business layer that sits between the presentation layer and the data layer consists of workflow, components, and entities. This layer deals with a variety of problems like security, caching, logging, and exception management. The data layer provides the data that an app needs. It includes data access components, utilities, and service tools. It has close interaction with the business layer.

There are preinstalled apps such as Calendar, Alarm, Email, Contacts, etc., and they may be downloaded for a price or for free from the Google Play Store, Apple Store, and Microsoft Store, among other places. On various platforms, there are millions of apps. Google Play Store has more apps than any other platform. As shown in Figure 6, the total number of mobile apps annually downloaded reached 230 billion in 2021.

Figure 6: Annual Number of Mobile App Downloads Worldwide



Source: ("Annual Number of Mobile App Downloads Worldwide," 2022)

Mobile apps are classified as either native or hybrid depending on their development. A native app is a software written in a particular programming language for a particular device or platform, such as iOS or Android. Swift or Objective-C programming languages are used to create native iOS apps, whereas Java or Kotlin programming languages are used to code native Android apps. On the other hand, hybrid applications are those that are developed using JavaScript, HTML, and CSS that run on a simplified browser called "WebView" within the app. The native apps are more expensive than the hybrid apps, but they are speedier.

Thanks to cross platform application development tools, creating native mobile apps has become more economical and faster. The codes of the application prepared with this method, which is called Cross-platform application development, are translated into native languages used on other platforms (Çınar & Bilici, 2020). There are three popular cross-platform application development technologies: Microsoft-powered Xamarin, Google-powered Flutter, and React Native, powered by Facebook. Xamarin translates code written using C# and Windows forms into native languages that will run on Windows, IOS, and Android platforms. Flutter is used to develop applications that will run on iOS, Android, Windows, Desktop, and the Web platforms using the Dart language. By the Framework, codes are translated into native codes used on related platforms. The React Native platform uses the JavaScript language, React frame, and style engine. The codes for applications are translated into native language codes used on the IOS and Android platforms. It is already used by Facebook, Instagram, Microsoft, Amazon, and thousands of other companies and organizations.

3.2.1.4. SQLite Database System

SQLite is a standalone, serverless, and self-configured database ("About SQLite," 2021). The software is open-source and free of charge for any commercial or specific purpose. SQLite is the most common database used in different applications. SQLite does not require a separate server clearance procedure, unlike other databases. SQLite uses a flat disk file to read and write data. A single disk contains many tables, indexes, triggers, and views. The file format is cross-platform; it can be used on 32-bit and 64-bit systems. Since an SQLite database does not require management, It is simple to use it without expert human assistance in mobile phones, set-top boxes, televisions, gaming consoles, cameras, clocks, kitchen appliances, thermostats, vehicles, machines, airplanes, remote control sensors, drones, medical equipment, and robots. SQLite is fast and reliable and allows convenient use without any configuration or maintenance.

3.2.2. worDBook App

3.2.2.1. Definition of the Project

worDBook is an Android-based mobile app that aims to teach English vocabulary with text, visuals, and audio to young learners, especially second, third, and fourth grade primary school students in Turkey. The learners are not only to study vocabulary under the different categories, but also to practice in order to enhance retention.

3.2.2.2. The Scope of the Project

The mobile app, after being downloaded from Google Play, will start with a splash screen, and after that, a vocabulary category list will be displayed. Upon choosing a vocabulary category, the activity list will be displayed. This activity list consists of study and practice screens. The study screen is to provide the words of the chosen category one by one with text, visuals, and audio. On the other hand, the practice screen is to provide a test of the words of the chosen category. The test's word collection is randomly composed by the interface. After each test, a report screen is displayed, which directs the user to the categories screen.

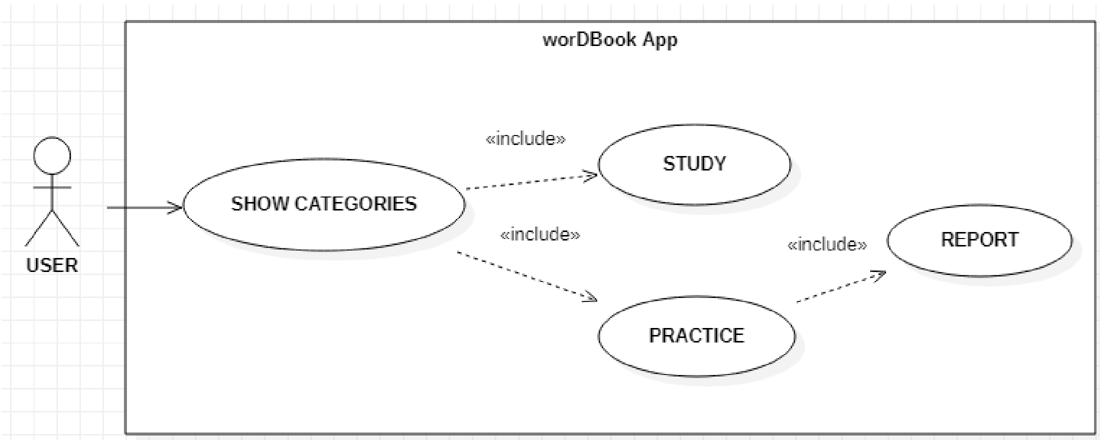
3.2.2.2.1. The Project's Need Analysis

This project needs both functional and non-functional requirements, which are detailed as follows.

3.2.2.2.2. Functional Requirements

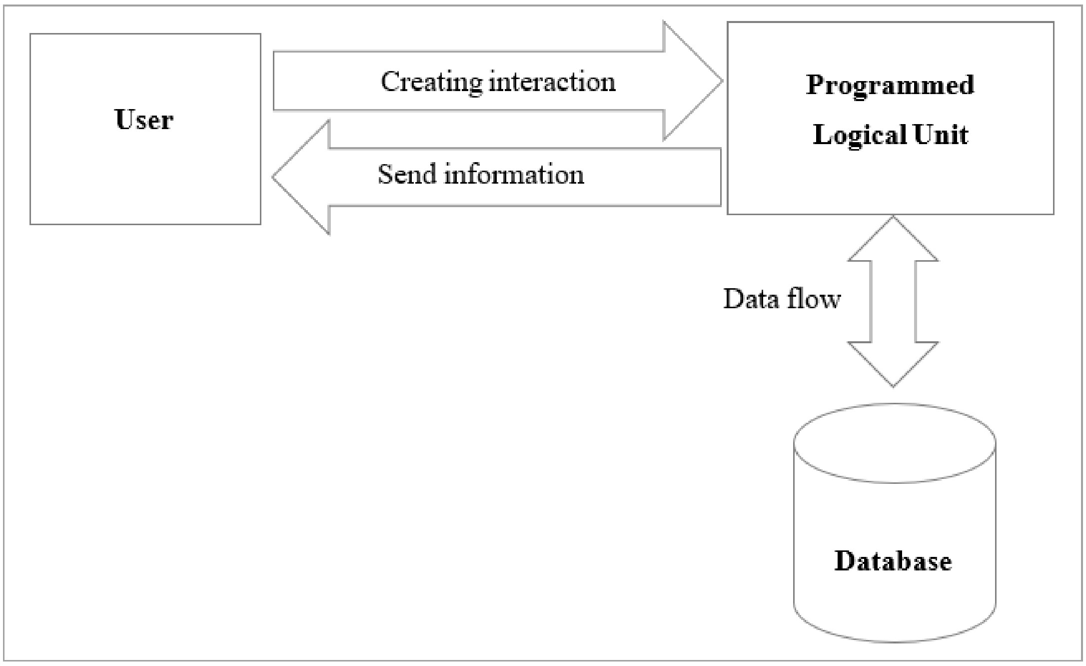
The app needs a starting screen with a logo, a word category list screen including an exit-button, an activity screen including Study and Practice activities and back-button. The study screen has a word's text, picture, Turkish meaning, a model sentence, a back-button, a next-button, and a toolbar with Study name and a back-button. The practice screen has a toolbar with Practice name and back-button, a text title including the question below the toolbar, pronunciation of each word, four-picture layout with a text and a next-button. A report screen that follows the end of each practice has a toolbar with Result name and back-button, a picture, and a text below the picture. The app's Use Case diagram, a graphical illustration of a user's interactions with the system, is depicted in Figure 7.

Figure 7: Use Case Diagram of the worDBook



The overall system architecture is depicted in Figure 8. It has a user interface to interact with the business logical unit. The logical unit retrieves the data the application needs from the SQLite database embedded in the Android operating system. The app aims to run on mobile phones and tablets with Android 4.1 and higher SDKs.

Figure 8: The Architecture of the worDBook



3.2.2.2.3. Non-functional Requirements

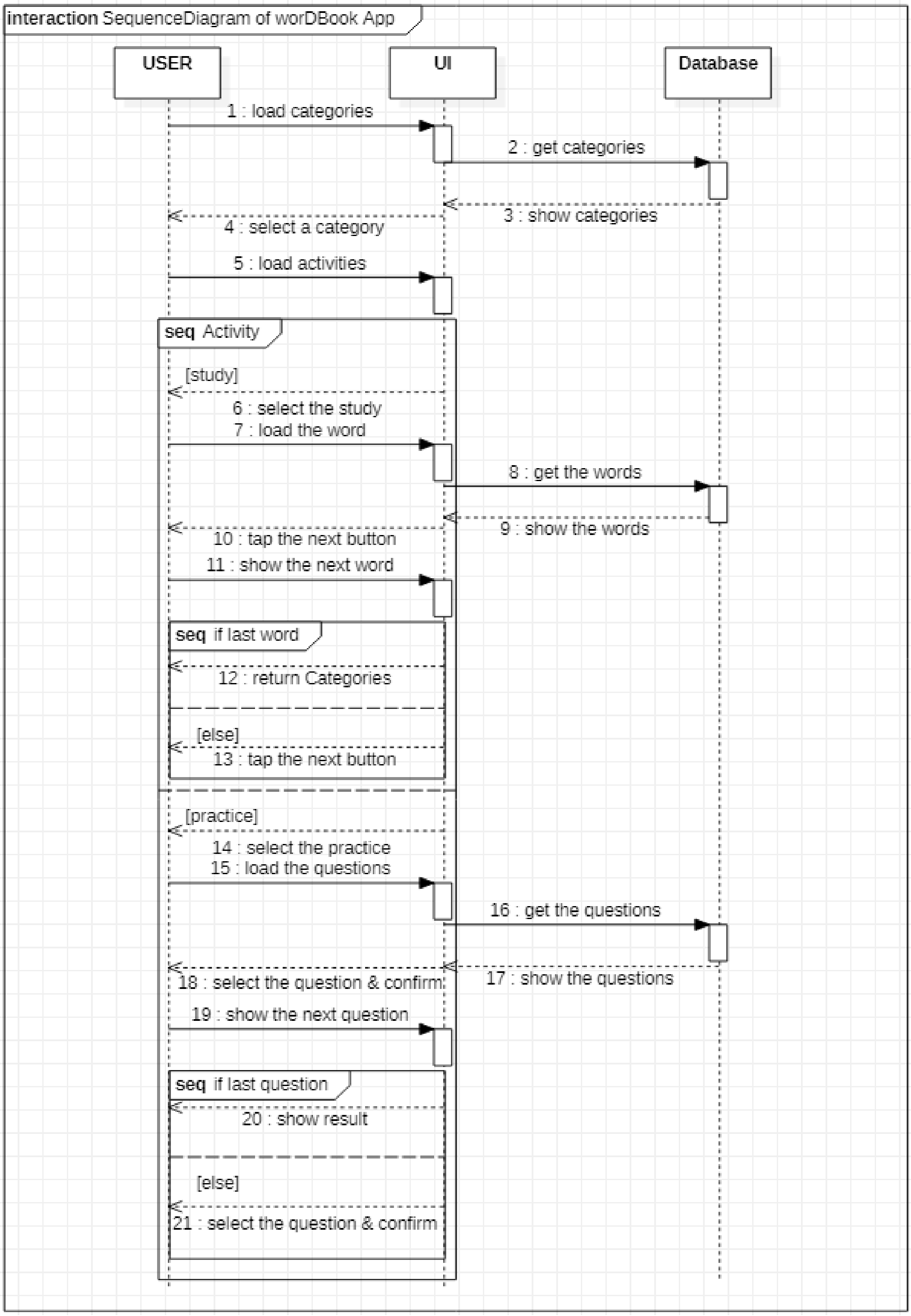
The app, as aimed at primary school students, should be not only user-friendly but also attractive and colorful.

3.2.2.3. Design of the System

3.2.2.3.1. Interaction Sequence Diagram of the worDBook App

Sequence Diagrams are flowcharts that show how processes are carried out. In a collaborative setting, they record the interaction between items. The vertical axis of the diagram is used to represent the time at which messages should be transmitted and when. Sequence diagrams are the focus of time and graphically depict the order of interaction. Figure 9 shows the Interaction Sequence Diagram of the worDBook.

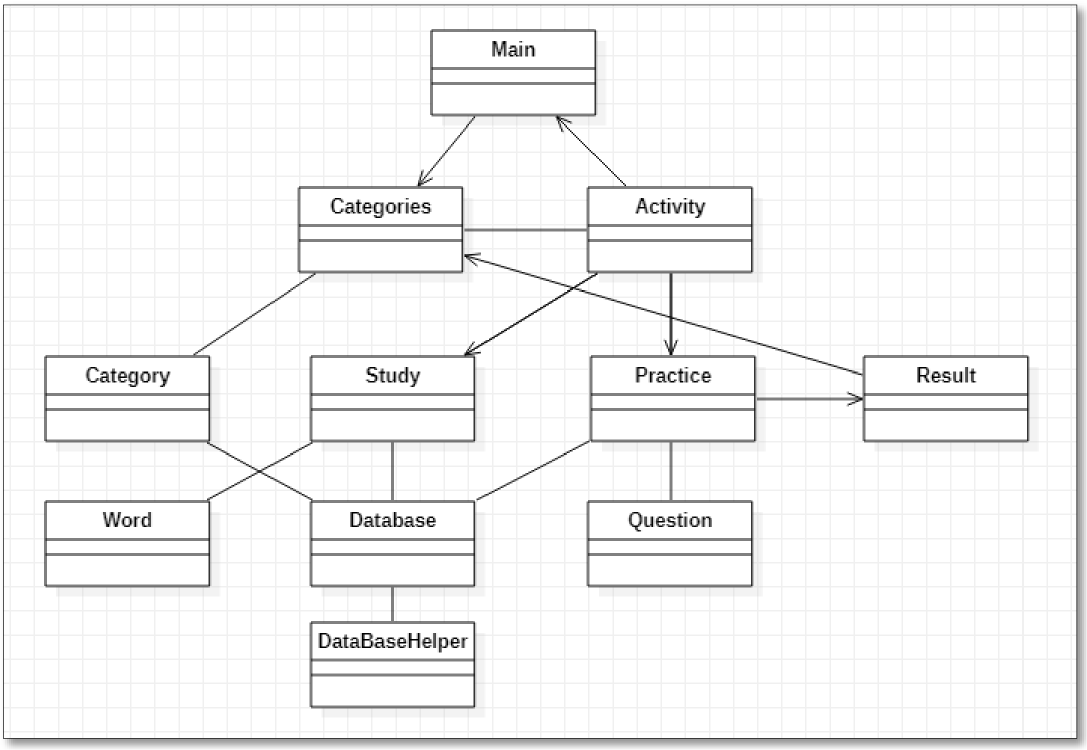
Figure 9: Interaction Sequence Diagram of the worDBook



3.2.2.3.2. Class Diagram

A class diagram is a type of static structural diagram in the Unified Modeling Language (UML) that illustrates the system's classes, attributes, operations, and interactions between objects to describe the system's structure. The worDBook's general class diagram is shown in Figure 10. The main activity is on the main screen of the application, and navigation starts from this activity.

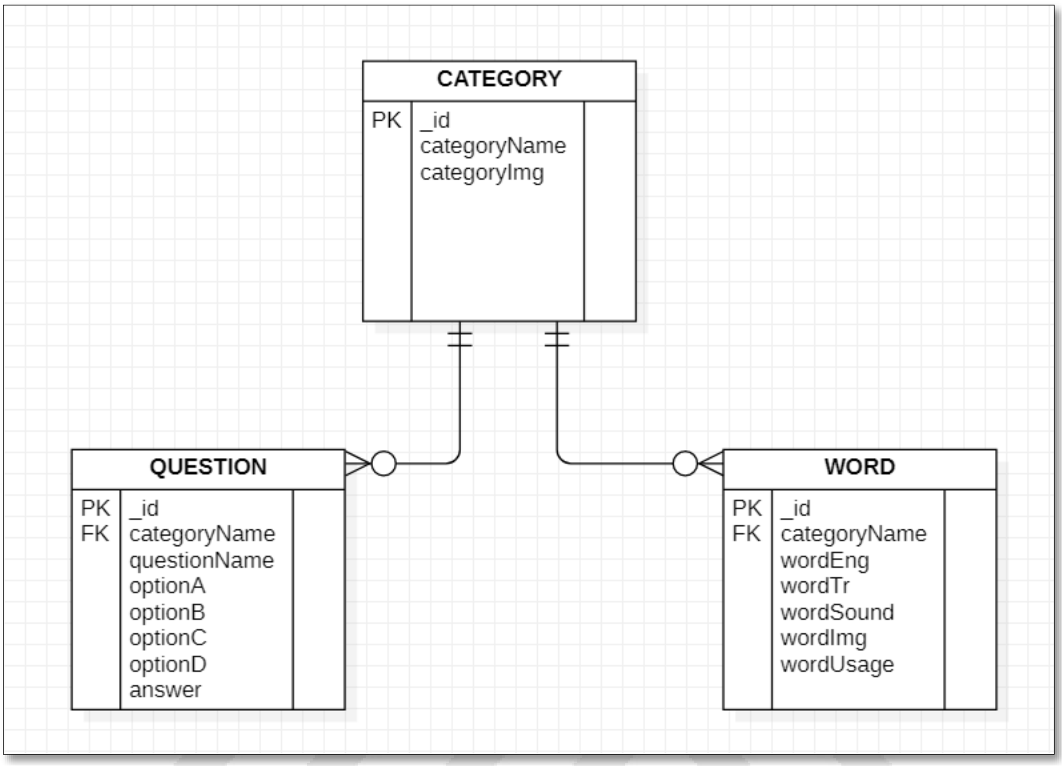
Figure 10: The Class Diagram of the worDBook



3.2.2.3.3. Database Design

A data model is a set of hashes, structures, and operations that are used to logically organize data (Yarımağan, 2016). Even though there are many database modeling techniques, Crow's Foot notation of the Entity Relationship Model (ERM) is used in this study for the database design of the program. Most of the time, the model is utilized for independent data analysis and modeling. There are three tables in the database of the worDBook: Category, Word, and Question. Figure 11 illustrates the database diagram, including these tables and their attributes.

Figure 11: Database Diagram (Entity-Relationship Diagram-ERD)



3.2.2.3.4. User Interfaces

The user interfaces of the worDBook are depicted in the following figures: the splash screen in Figure 12, the word-category list in Figure 13, the activities in Figure 14, the study in Figure 15, the practice in Figure 16, and the report in Figure 17.

Figure 12: Splash Screen

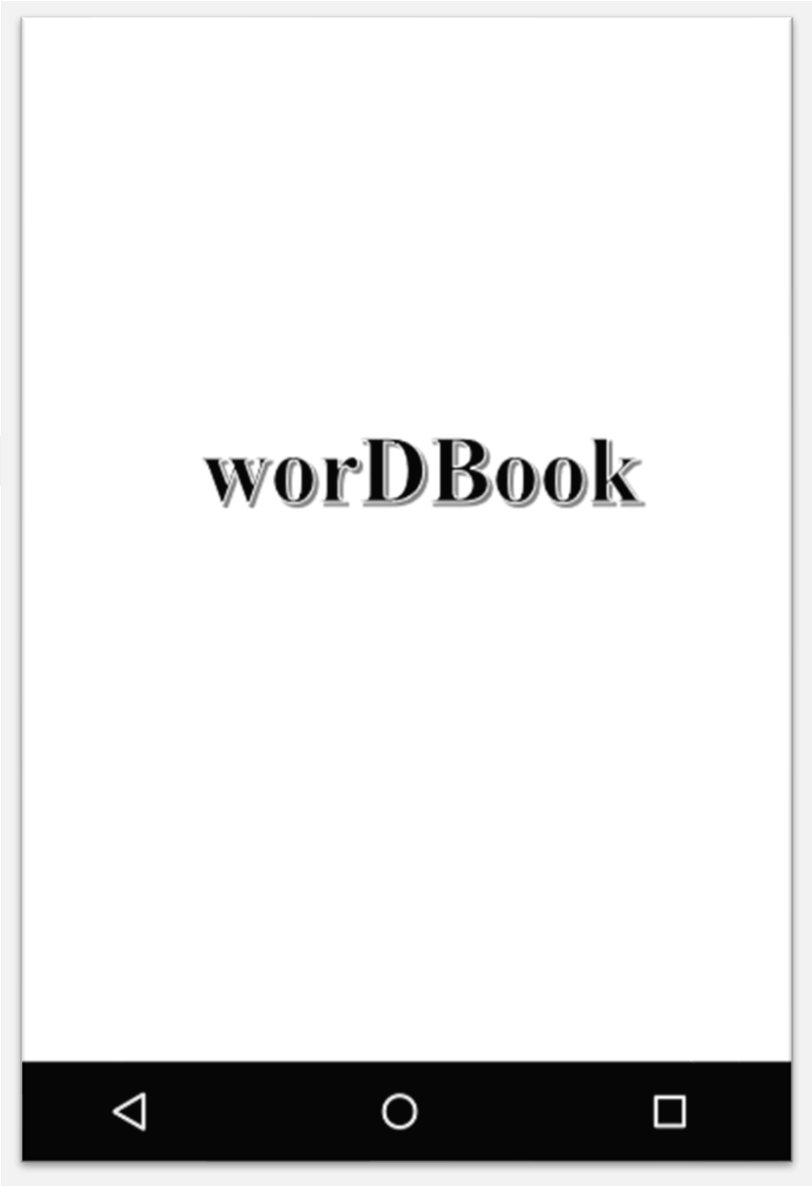


Figure 13: Word-Category List Screen

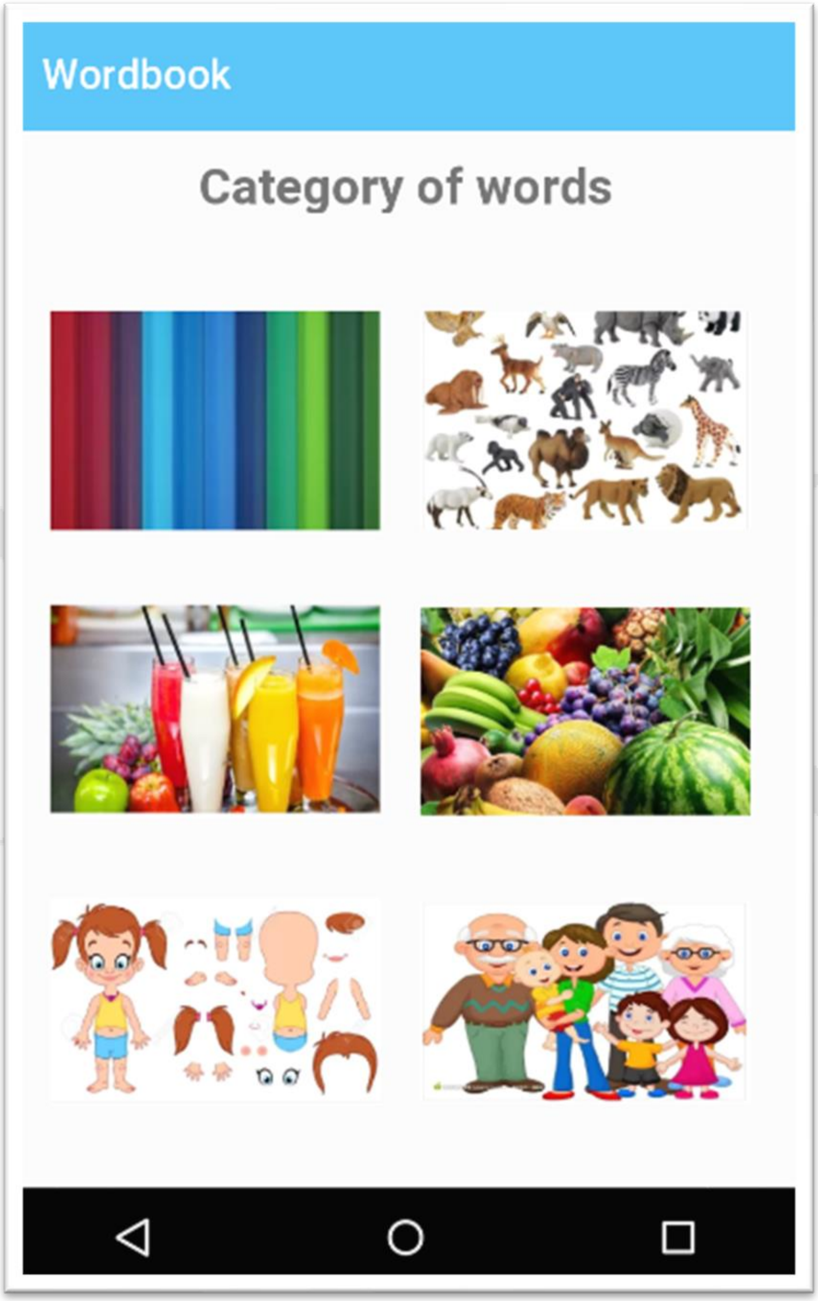


Figure 14: Activities Screen

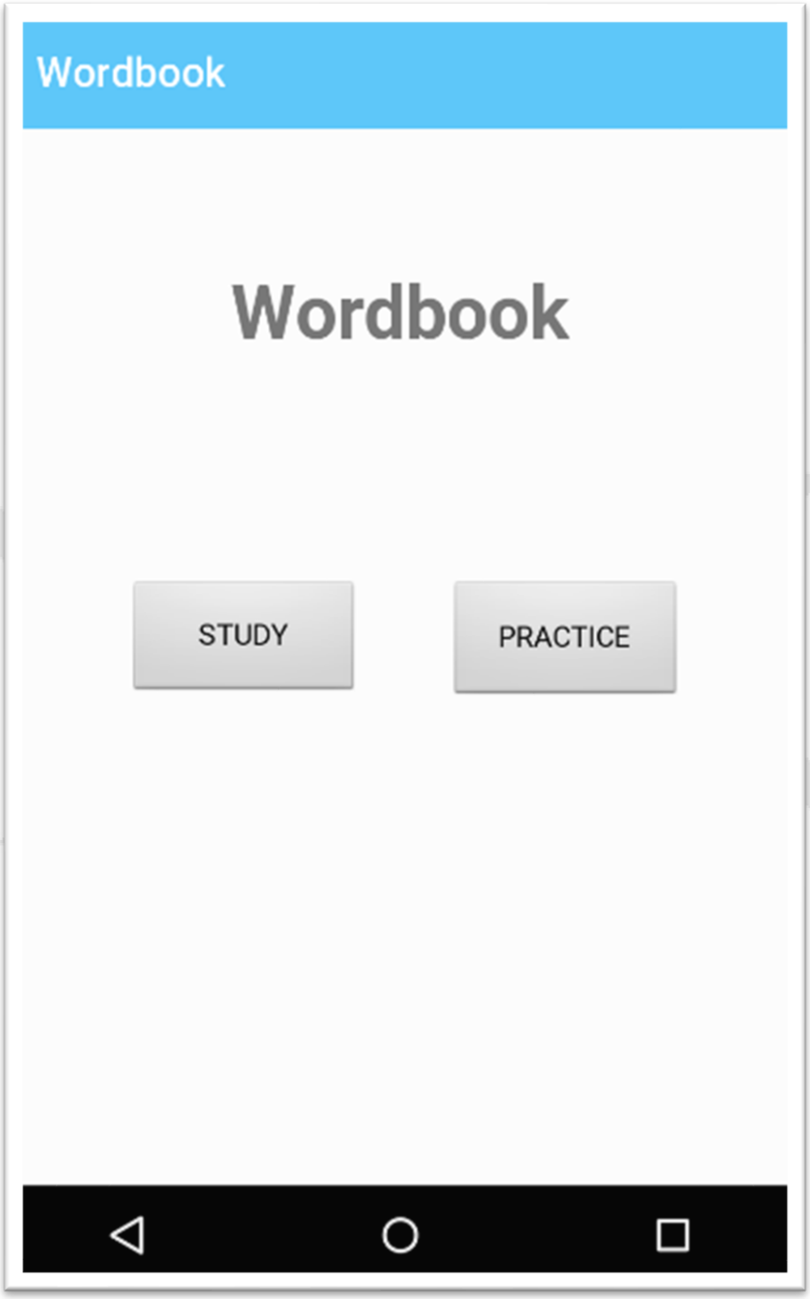


Figure 15: Study Screen

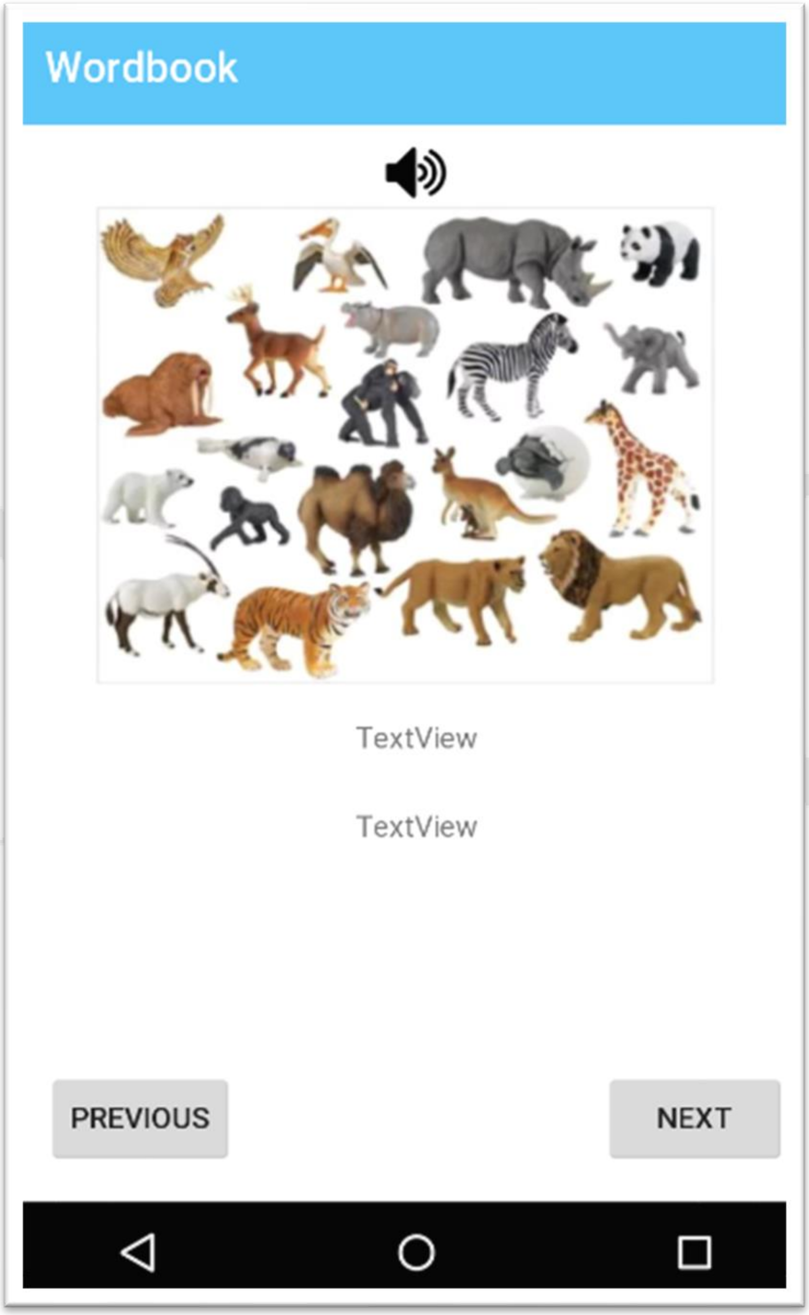
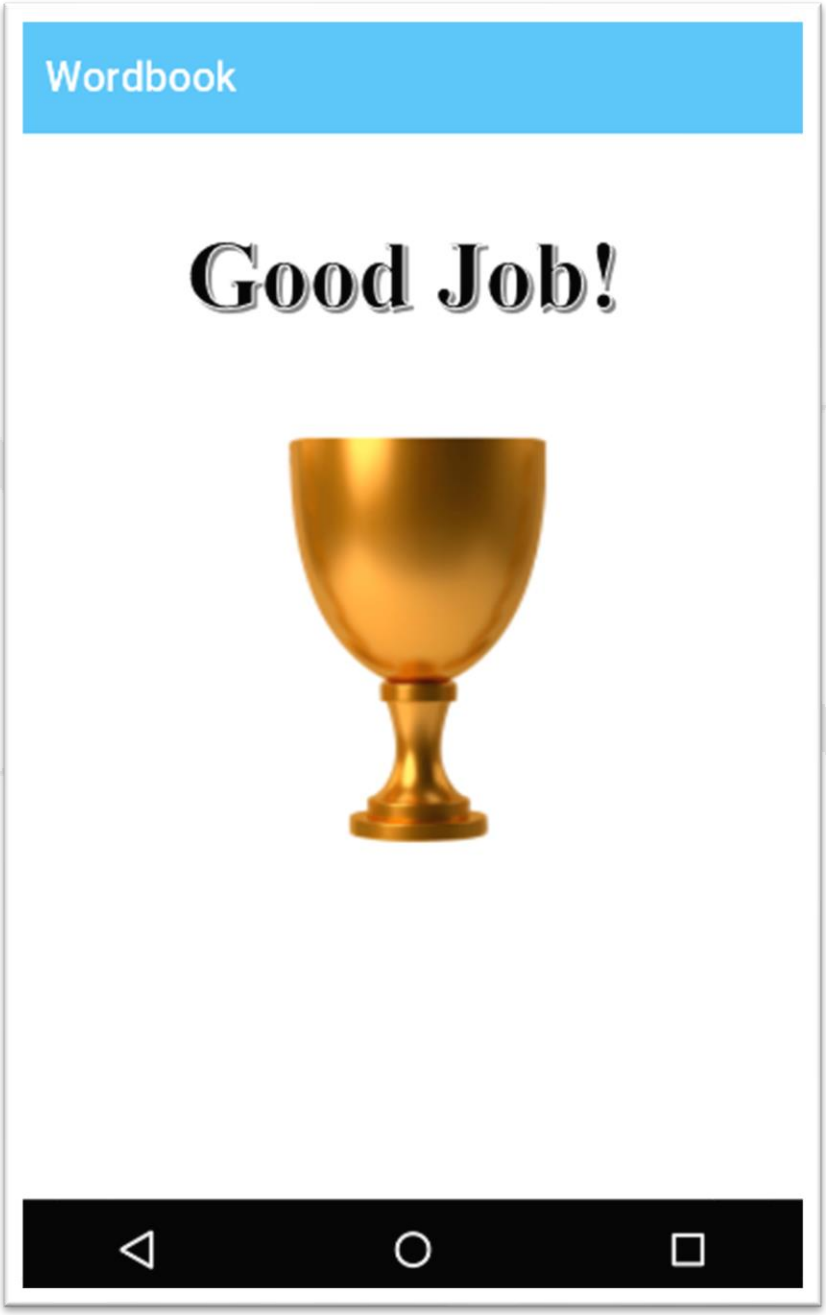


Figure 16: Practice Screen

Figure 17: Report Screen



3.2.2.4. Implementation of the System

The implementation of the worDBook consists of coding and creating a database. In order to achieve this, the following software developmental tools that are depicted in Table 7 are required and used.

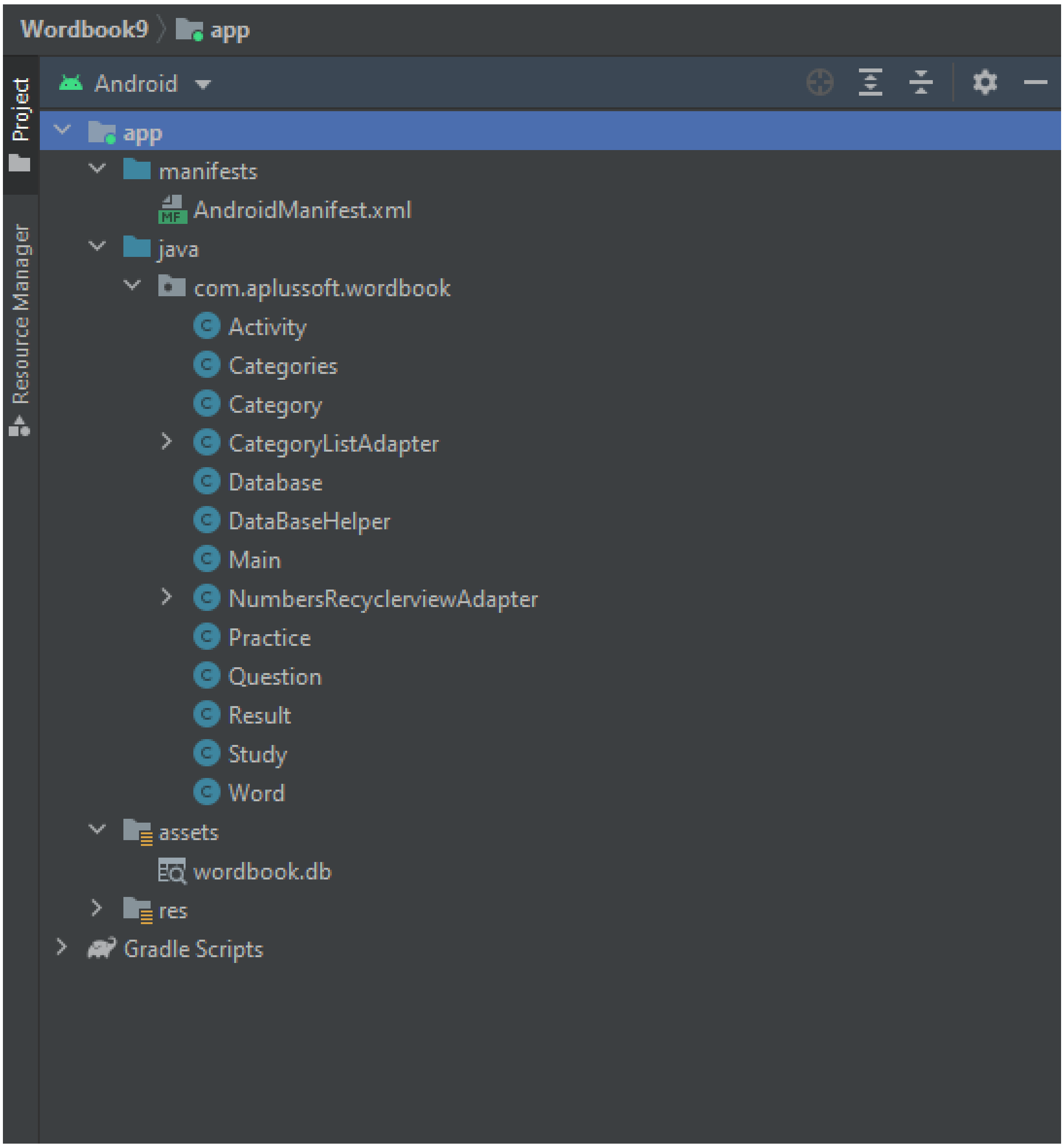
Table 7: The Software Developmental Tools

Requirement	Explanation
Computer	Windows OS
Intel Hardware Accelerated Execution Manager (HAXM)	For Emulator
Java Development Kit	Version 1.8.
Android Software Development Kit	Android 4.1 and Android 11.0
Android Studio	Version 3.4
Emulator	Android 5.0 and Android 11.0
DB Browser for SQLite	For loading the words to Database
Database	SQLite
Evolus Pencil	User interface design
Mobile phones	Android 5.0 and Android 11.0
Tablet	Android 4.1
StarUML Software	For creating diagrams
SQLite Expert Personal 5 - 64bit Software	For creating database

3.2.2.4.1. Coding

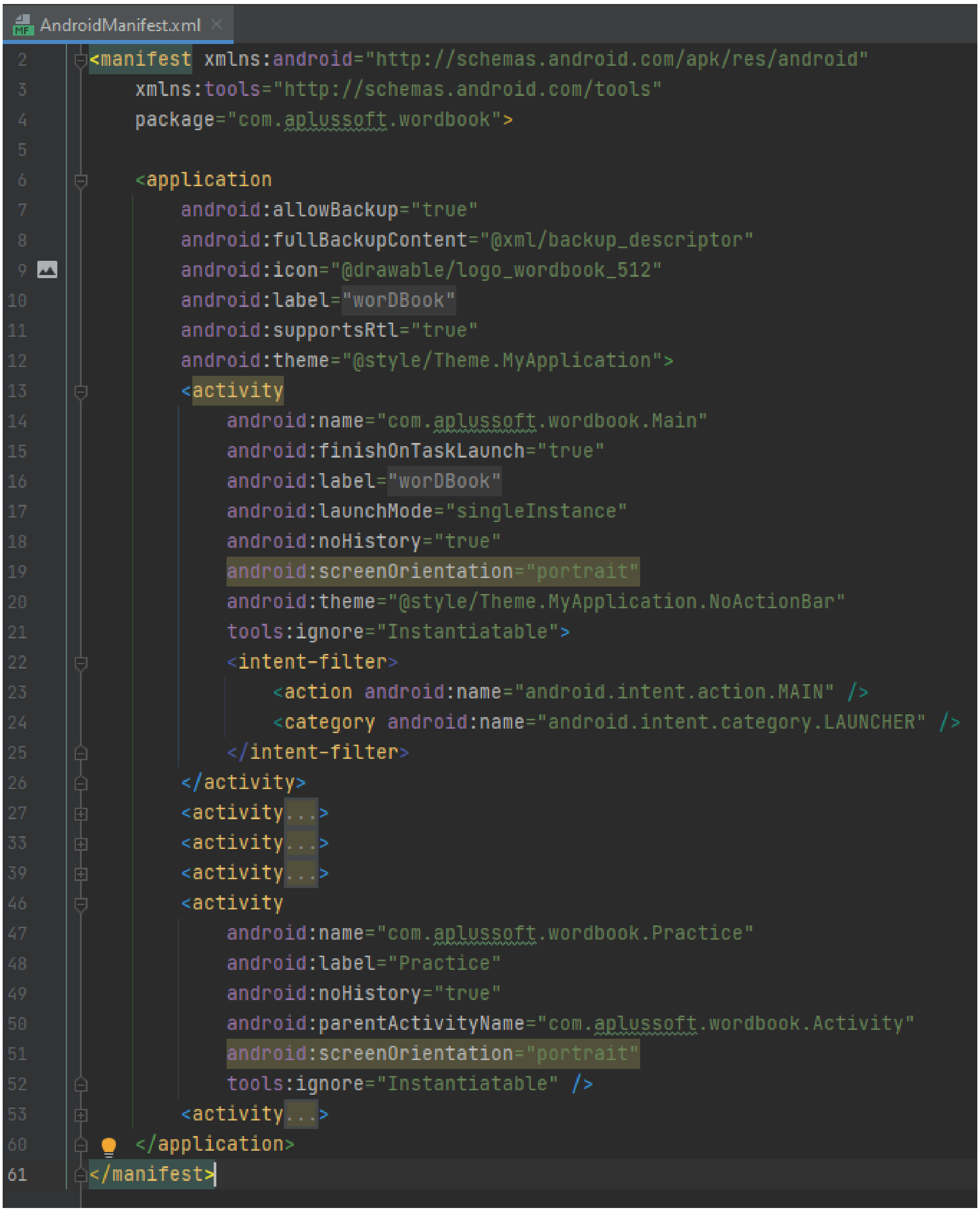
The Java programming language was used to construct the app in the Android Studio IDE (Arctic Fox, version 11.0.10). Android Studio has a modular structure that contains everything from source code to entities, test code, and configurations that define an application's workspace. Figure 18 depicts the project index structure. AndroidMafiest.xml, Java files, assets, res (resources), and Gradle files make up the majority of the project.

Figure 18: The Project Index Structure



The AndroidManifest file, shown in Figure 19, is located in the root of the project source set. It provides app-specific information that is required by the Android development tools, Android OS, and Google Play Store.

Figure 19: The Screenshot of AndroidManifest.xml



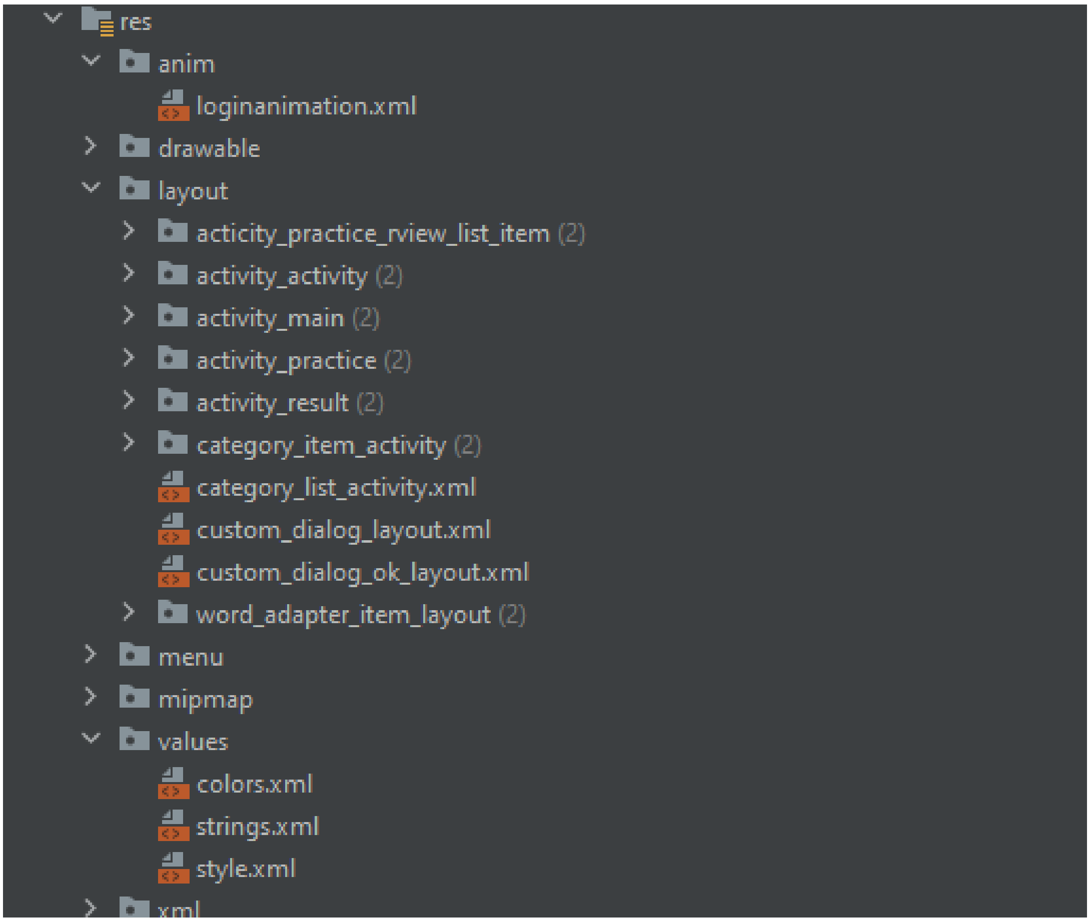

```xml
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    package="com.aplussoft.wordbook">

    <application
        android:allowBackup="true"
        android:fullBackupContent="@xml/backup_descriptor"
        android:icon="@drawable/logo_wordbook_512"
        android:label="worDBook"
        android:supportsRtl="true"
        android:theme="@style/Theme.MyApplication">
        <activity
            android:name="com.aplussoft.wordbook.Main"
            android:finishOnTaskLaunch="true"
            android:label="worDBook"
            android:launchMode="singleInstance"
            android:noHistory="true"
            android:screenOrientation="portrait"
            android:theme="@style/Theme.MyApplication.NoActionBar"
            tools:ignore="Instantiatable">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity...>
        <activity...>
        <activity...>
        <activity
            android:name="com.aplussoft.wordbook.Practice"
            android:label="Practice"
            android:noHistory="true"
            android:parentActivityName="com.aplussoft.wordbook.Activity"
            android:screenOrientation="portrait"
            tools:ignore="Instantiatable" />
        <activity...>
    </application>
</manifest>
```

The Java section depicted in Figure 18, aforementioned, has all classes created according to the class diagram. It also contains the test part of the app.

The assets section depicted in Figure 18 covers the database of the app that is embedded in the app.

The resource section includes animations, images, icons, layouts, menus, audio, colors, styles, and strings used in the app. The app's user interfaces are developed in the layouts section and bonded with the database using Java codes. Figure 20 depicts the screenshot of the res folder, including subfolders.

Figure 20: The Screenshot of the res Folder



The build.gradle module defines configurations that apply to all modules of the project. The build.gradle file is an integral part of the project, so it should keep it under revision control with all the other source code. The build.gradle file contents of the project are shown in Figure 21.

Figure 21: The Screenshot of the build.gradle File

```
plugins {
    id 'com.android.application'
}

android {
    compileSdkVersion 30
    defaultConfig {
        applicationId 'com.aplussoft.wordbook'
        minSdkVersion 16
        targetSdkVersion 30
        versionCode 6
        versionName "1.0.5"
        testInstrumentationRunner "android.support.test.runner.AndroidJUnitRunner"
    }
    buildTypes {
        release {
            minifyEnabled false
            proguardFiles getDefaultProguardFile('proguard-android.txt'), 'proguard-rules.pro'
        }
    }
    buildToolsVersion '30.0.3'
}
android {
    defaultConfig {
        // Enabling multidex support.
        multiDexEnabled true
    }
}
dependencies {
    implementation fileTree(include: ['*.jar'], dir: 'libs')
    releaseImplementation 'androidx.appcompat:appcompat:1.3.0'
    implementation 'com.google.android.material:material:1.3.0'
    implementation 'androidx.constraintlayout:constraintlayout:2.1.1'
    implementation 'androidx.navigation:navigation-ui:2.3.5'
    implementation 'org.apache.commons:commons-text:1.7'
    androidTestImplementation 'androidx.test.ext:junit:1.1.3'
    androidTestImplementation 'androidx.test.espresso:espresso-core:3.4.0'
}

```

3.2.2.4.2. Creating Database

The database for the app has been created via the SQLite Expert Personal 5 program. First, three tables, which are depicted in Figure 22, have been created according to the Database Diagram in the program, and database creation, connection, and listing queries used in the project are created in Database.java and

DatabaseHelper.java files. Second, the content of the database is taken from the English books of the public primary school. The books cover second, third, and fourth grades. Third, the sounds of the words have been created by the use of the Anki program. Fourth, the images of the words have come from open-source resources, and Canva and Microsoft office programs are used for editing images. Fifth, all words with their English and Turkish meanings, images, and sounds have been loaded into the database file by using the SQLite Expert Personal 5 program. Finally, the file has been copied to the asset folder in Android Studio to be accessed in the app. As the embedded database is used in this app, an internet connection is not needed after downloading the app from the Google Play Store.

Figure 22: The Tables of the Database

```
CREATE TABLE "category" (
  "_id" INTEGER NOT NULL ON CONFLICT REPLACE PRIMARY KEY AUTOINCREMENT,
  "categoryName" TEXT,
  "categoryImg" BLOB
);

-- Table: question
CREATE TABLE [question](
  [_id] INTEGER PRIMARY KEY AUTOINCREMENT,
  [categoryName] TEXT,
  [questionName] TEXT,
  [optionA] TEXT,
  [optionB] TEXT,
  [optionC] TEXT,
  [optionD] TEXT,
  [answer] TEXT
);

-- Table: word
CREATE TABLE word (
  _id INTEGER NOT NULL ON CONFLICT REPLACE PRIMARY KEY AUTOINCREMENT,
  categoryName TEXT NOT NULL ON CONFLICT REPLACE,
  wordEng TEXT,
  wordTr TEXT,
  wordSound BLOB,
  wordImg BLOB,
  wordUsage TEXT
);
```

3.2.2.4.3. User Interfaces of the worDBook

After coding, all user interfaces, including splash, category, activity, study, practice, and result, are respectively shown in Figures 23 to 29.

Figure 23: The Screenshot of Splash Screen

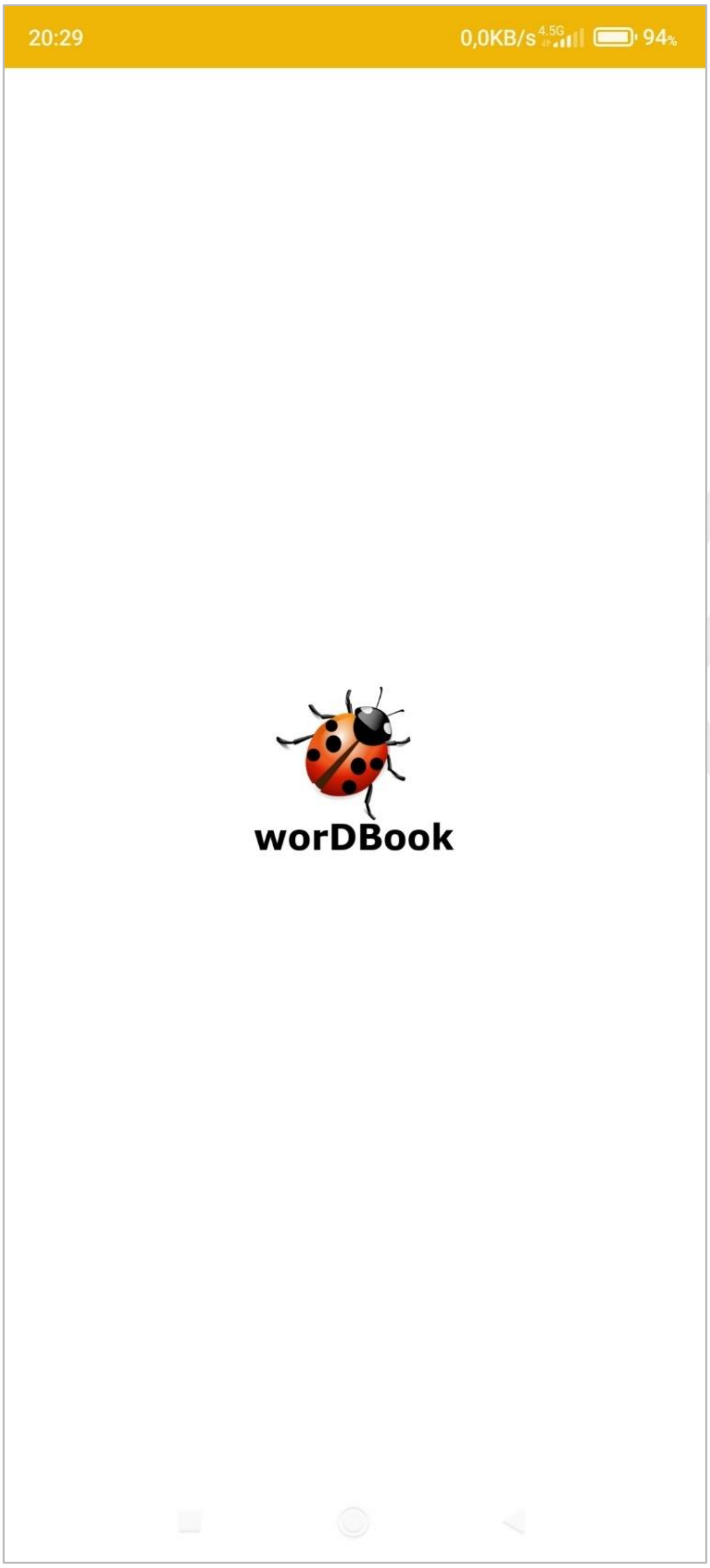


Figure 24: The Screenshot of the Categories of Words

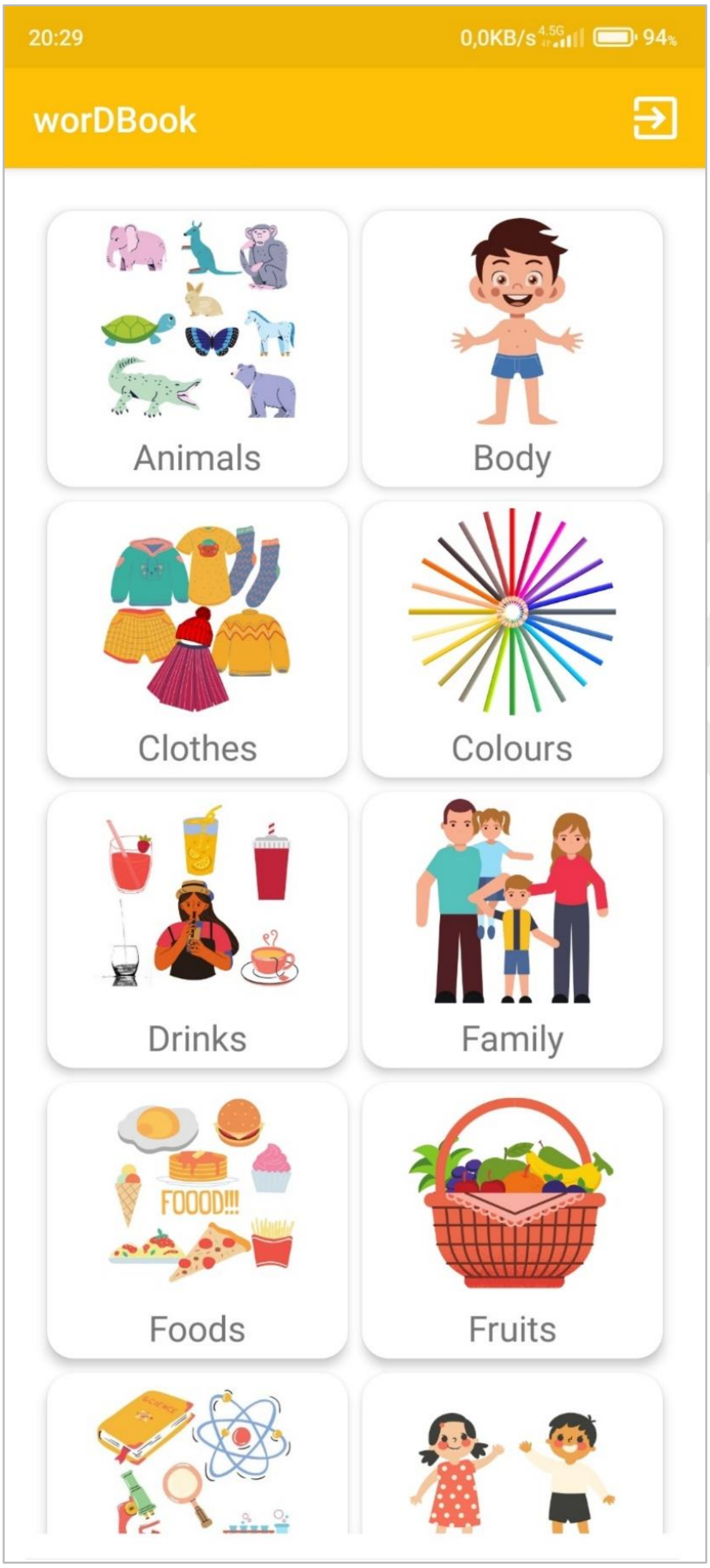


Figure 25: The Screenshot of the Activities

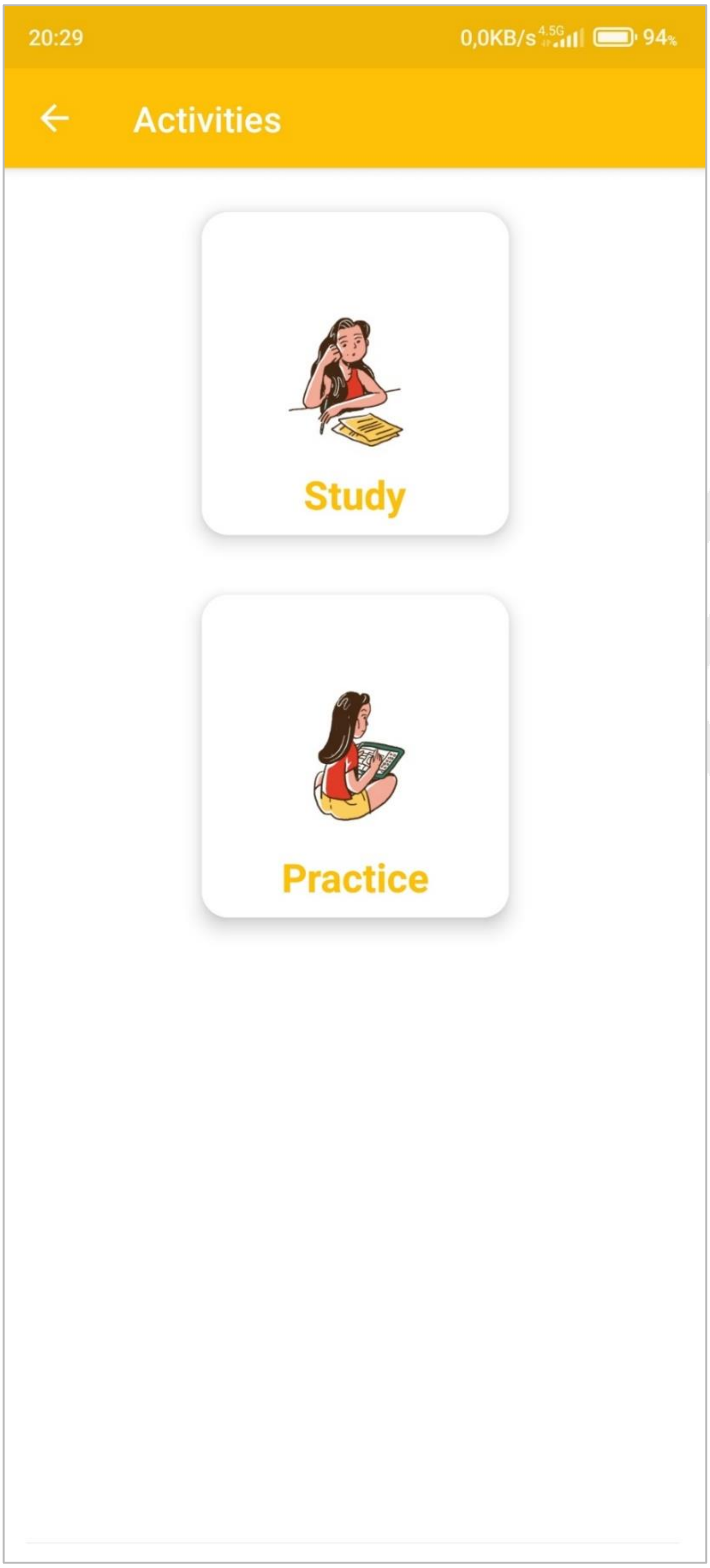


Figure 26: The Screenshot of the Study

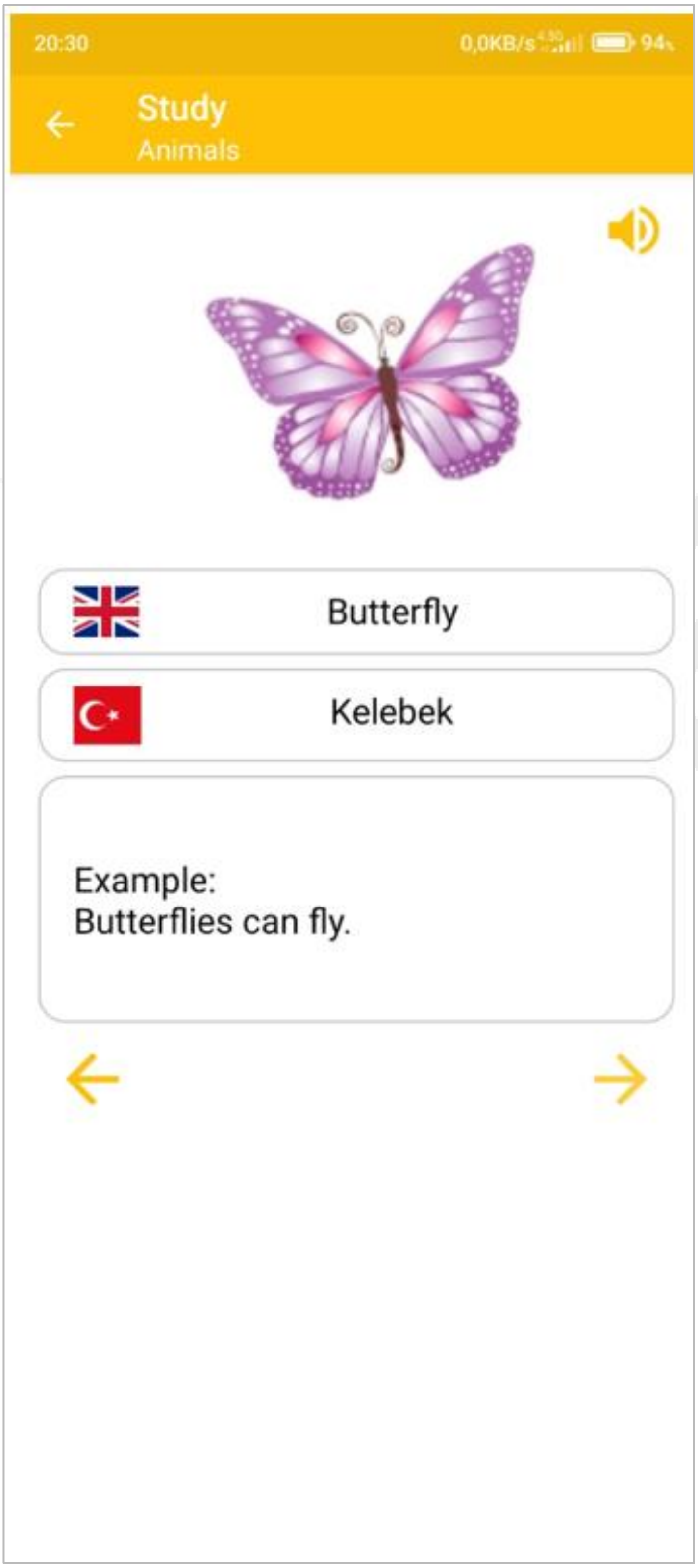


Figure 27: The Screenshot of the Completion of the Study

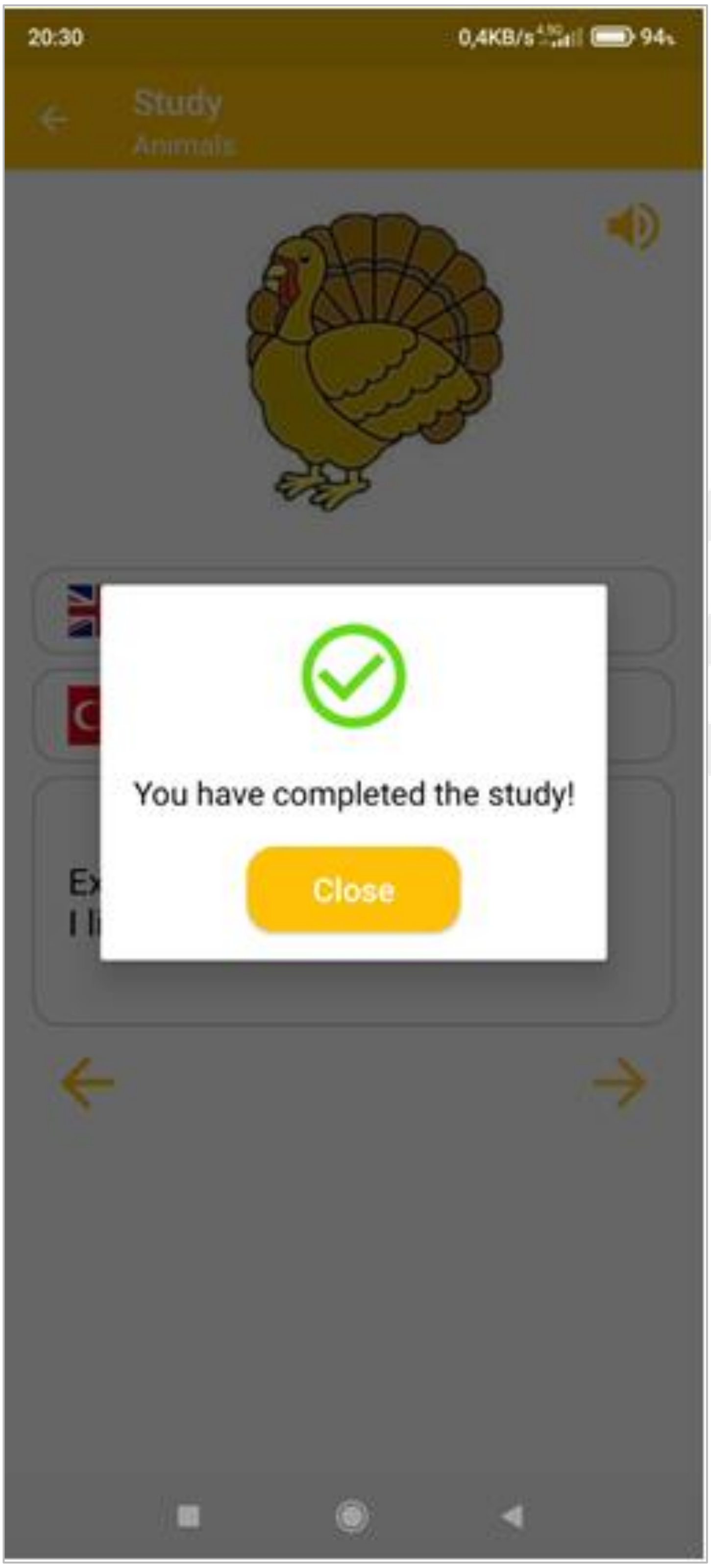


Figure 28: The Screenshot of the Practice

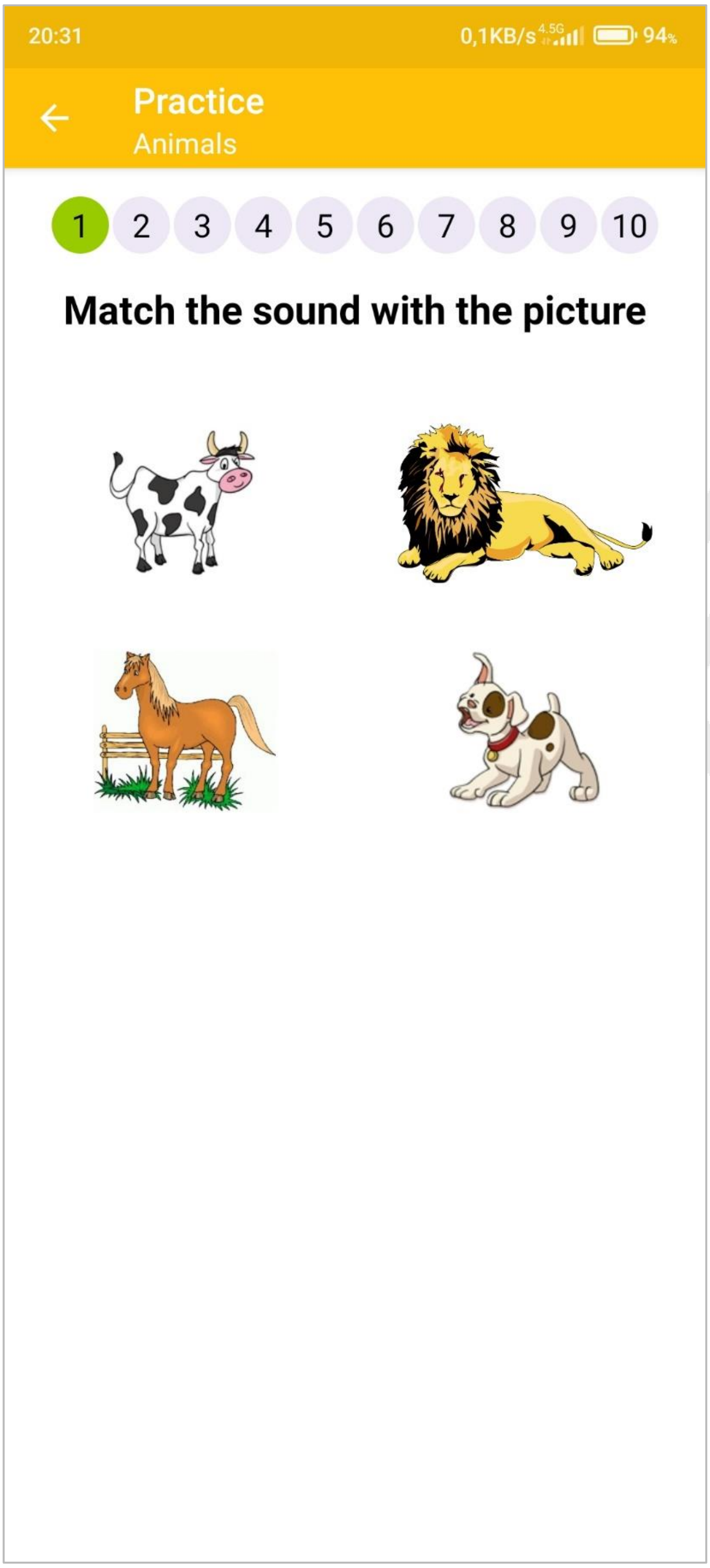
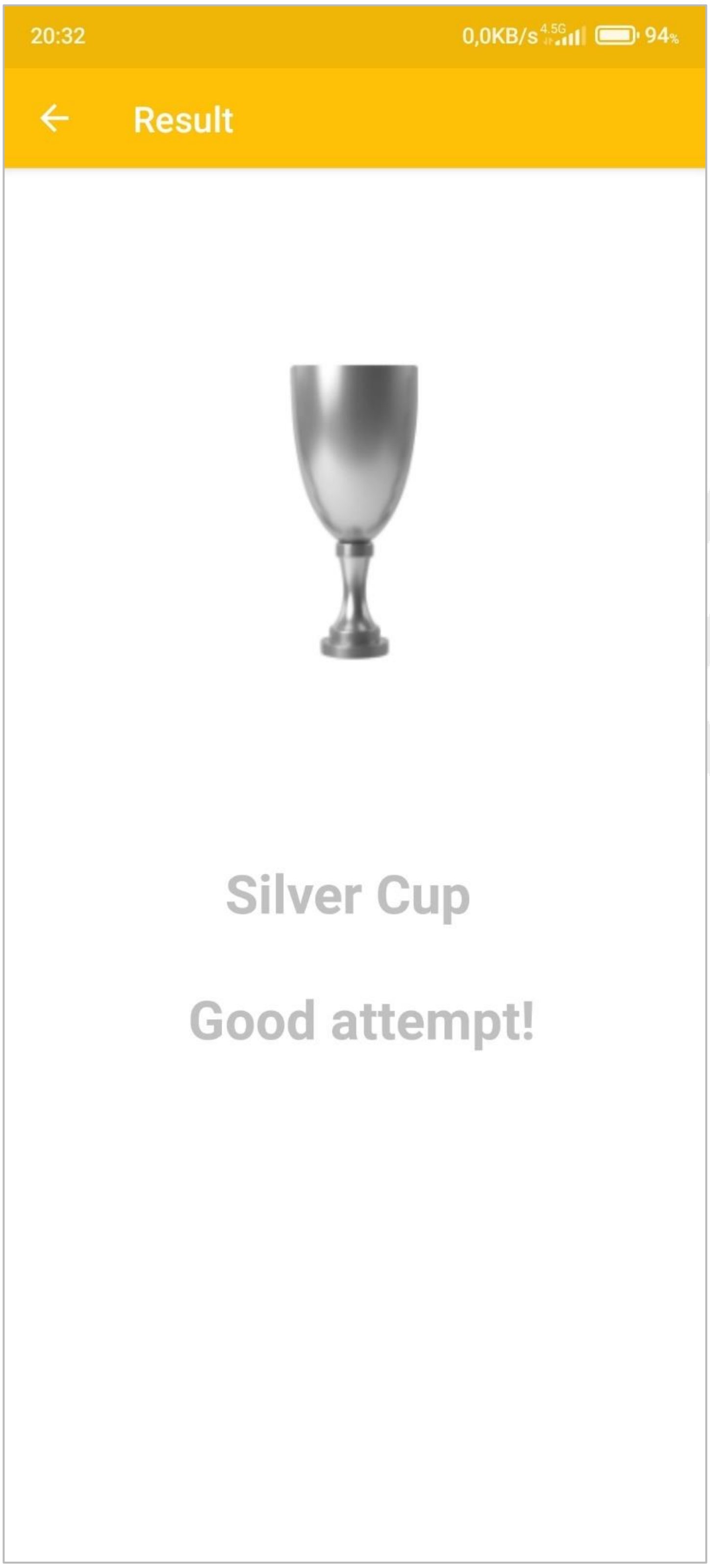


Figure 29: The Screenshot of the Result



3.3. Test and Refinement of the System

3.3.1. Test of the System

Testing of the app is an important process for the improvement of the product, and thereby making it more efficient for its users.

The developed app was tested for two days. The test tools that were used are the Android Studio emulator, Nexus 5X API 27, and mobile devices, such as the Xiaomi Poco F2 Pro smart phone with Android 11.0, and the Samsung 10.1 Tablet with Android 4.4. The functions of the app depicted in Table 8 were tested on the emulator, the phone, and the tablet.

Table 8: Functional Tests

Activity Name	Tested Functions
Splash	1. The logo will appear and after two seconds, Category activity is to start.
Category	2. Toolbar with logo on the left, worDBook. 3. Grid word category list with word picture and name below it. 4. Upon tapping a category, open the activity screen.
Activity	5. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start. 6. Activity of Study and Practice with picture and name below the picture. 7. Upon tapping Study or Practice, it is to open either Study or Practice activity.
Study	8. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start. 9. The words of the chosen category are to appear on the screen with the form from the top to bottom, the word's pronunciation, picture,

Activity Name	Tested Functions
	English meaning, Turkish meaning, model sentence, back and next button.
	10. Upon tapping the back or next button, a new word is to appear in the form mentioned.
Practice	11. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start.
	12. The questions of the chosen category are to appear on the screen with form from the top to bottom, question's text, four different pictures of the words, word's pronunciation, and next button.
	13. If one of the photographs is accurate, feedback should show at the bottom of the app after tapping it.
	14. Upon tapping next button, a new question is to appear in the form mentioned. If it is last question, Result activity is to start.
Result	15. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start.
	16. The result activity has a balloon, a bronze, silver, and gold cup with the text. According to the performance of the user in the practice test, one of them is to appear on the screen.

The app developed has been tested successfully on the emulator, the phone, and the tablet. The results of the test are depicted in Table 9.

Table 9: Test Results

Tested Functions	Emulator	Phone	Tablet
1. The logo will appear and after two seconds, Category activity is to start.	Passed	Passed	Passed
2. Toolbar with logo on the left, worDBook.	Passed	Passed	Passed
3. Grid word category list with word picture and name below it.	Passed	Passed	Passed
4. Upon tapping a category, open the activity screen.	Passed	Passed	Passed
5. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start.	Passed	Passed	Passed
6. Activity of Study and Practice with picture and name below the picture.	Passed	Passed	Passed
7. Upon tapping Study or Practice, it is to open either Study or Practice activity.	Passed	Passed	Passed
8. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start.	Passed	Passed	Passed
9. The words of the chosen category are to appear on the screen with the form from the top to bottom, the word’s pronunciation, picture, English meaning, Turkish meaning, model sentence, back and next button.	Passed	Passed	Passed

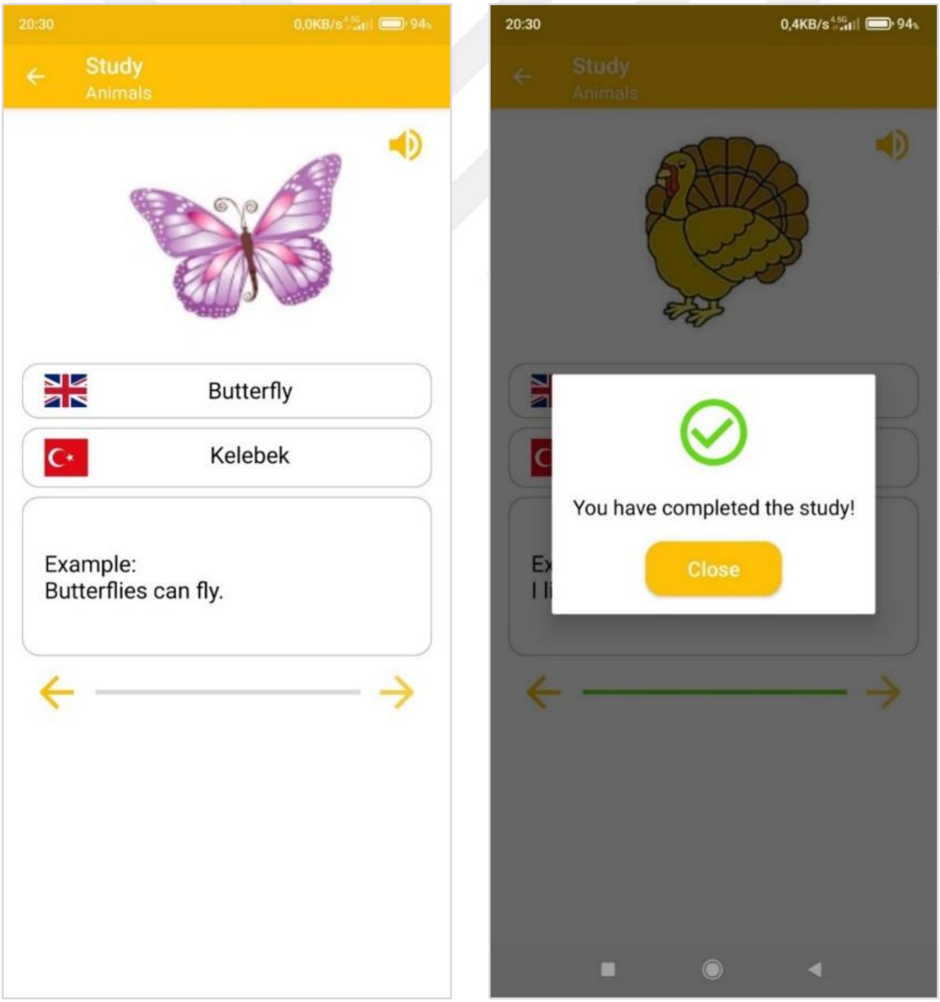
Tested Functions	Emulator	Phone	Tablet
10. Upon tapping the back or next button, a new word is to appear in the form mentioned.	Passed	Passed	Passed
11. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start.	Passed	Passed	Passed
12. The questions of the chosen category are to appear on the screen with form from the top to bottom, question's text, four different pictures of the words, word's pronunciation, and next button.	Passed	Passed	Passed
13. If one of the photographs is accurate, feedback should show at the bottom of the app after tapping it.	Passed	Passed	Passed
14. Upon tapping next button, a new question is to appear in the form mentioned. If it is last question, Result activity is to start.	Passed	Passed	Passed
15. Toolbar with a back arrow icon and the logo of the worDBook. Upon tapping the back arrow icon, Category activity is to start.	Passed	Passed	Passed
16. The result activity has a balloon, a bronze, silver, and gold cup with the text. According to the performance of the user in the practice test, one of them is to appear on the screen.	Passed	Passed	Passed

3.3.2. Refinement of the worDBook

The app was successfully tested according to the plan, and after that, there were some improvements that were desired to be made in order to increase the app's usability and efficiency.

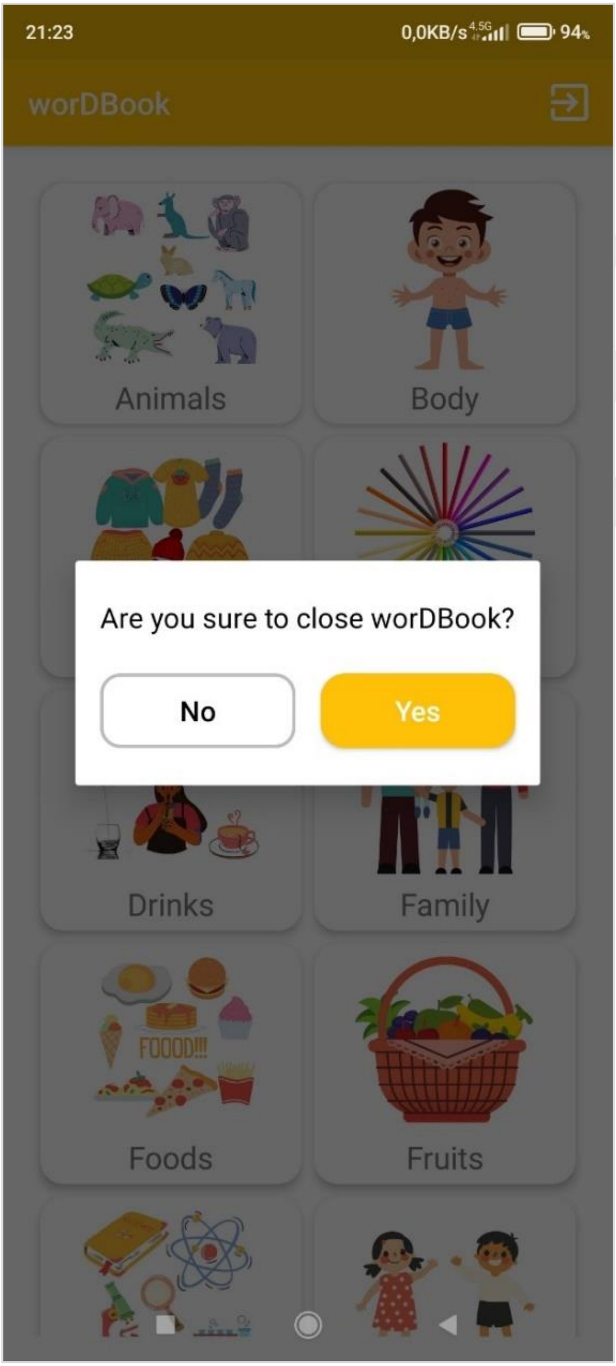
In terms of the refinements to the user interfaces, the first one is related to the theme of the app. The app's light blue color theme is changed to amber as the white on the light blue causes reading difficulties in light. The second UI refinement relates to the Study screen. On the screen, in order to track the statue of the study, an indicator was added between the two arrows at the bottom of the screen. Figure 30 shows this refinement.

Figure 30. Study Screen



The last improvement to the UI concerns category screen. The alert dialogue shown in Figure 31 is added to the category screen and, thus, when the exit icon is tapped, it appears on the screen with "No" and "Yes" options for staying or exiting the app. This way, unintentional tapes by users get under control.

Figure 31: Alert Dialogue



As for refinements to the database, first the app was tested by the teachers in order to get their feedback about the app's functions, UIs, and content before being used by students. In accordance with their feedback, some words, pictures, and sentences that had grammar errors or were misspelled were refined as follows:

- "Squirrel eats nuts" to "Squirrels eat nuts"
- "kangoroo" to "kangaroo"
- "There are three ant" to "There are three ants"
- "Glues" to "glue"
- "Occupations" to "Jobs"
- "We use the bedroom for shower" to "We use the bathroom for shower"
- "Television" to "TV"
- "Bakerry" to "Bakery"

3.4. Data Analysis and Results

After refinement of the app, a usability test was conducted so as to get user viewpoints and see if the system is useful or not.

3.4.1. Participants and Instruments

The study includes 146 participants from three distinct public primary schools in Balıkesir, Turkey. The participants are fourth-grade students who have or can access an Android-based smart phone or tablet.

In order to measure the usability of the worDBook, the Turkish version of the System Usability Scale (SUS-TR), originally developed to validate a system's usability by Brooke (Brooke, 1996), was used in this study. It's a simple and quick way to assess how a product or system's consumers feel about it (Brooke, 1996; Demirkol & Şeneler, 2018; Peres, Pham, & Phillips, 2013; Sauro, 2018). As the target group is the fourth-grade students and their English language proficiency level was considered, the SUS-TR, translated from English by Demirkol and Şeneler (2018), was preferred to be used with their consent. Participants responded to a five-point Likert-type scale inquiry with responses of fully agree (5), agree (4), neutral (3), slightly agree (2), and utterly disagree (1). The scale's Cronbach's alpha was computed as .840 and was seen as very highly reliable by different studies (Brooke, 1996; Peres et al., 2013) even though in his paper, Brook (1996) did not reveal any statistics about Cronbach's alpha and argued that it has a high amount of face validity for assessing a system's usability by including a wide range of factors like the need for help, training, and complexity.

3.4.2. Data collection procedures

The printed scale was used to collect information. The aim of the study and the procedure were explained to the English language teachers of the students. According to their feedback, some improvements were made. Before the questionnaire was applied, both parents and students were informed about the app, how to download it on their devices, and the questionnaire by the teachers. The parents and students were ensured that the data that was to be collected from them through this questionnaire was only going to be used for research purposes. The responses from all the participants who downloaded and used the app were taken in two weeks. Despite 220 downloads, 146 students completed the survey, and the data was entered into a spreadsheet for statistical analysis.

3.4.3. Data Analysis

In the statistical analysis phase, both validity and reliability analyses were conducted. As the scale was administered to a new and different group, the structural validation test of the instrument was required to be conducted again. In order to do so, first an explanatory factor analysis (EFA) was conducted, and then a confirmatory factor analysis (CFA) was achieved. Finally, the scale's reliability analysis was examined.

3.4.4. Results

3.4.4.1. Validity and Reliability Analyses

In this part of the study, both validity and reliability analyses were conducted for the adopted SUS-TR, which is shown in Appendix B. First, both EFA and CFA were carried out. However, before doing EFA and CFA, the assumptions of factor analysis were tested. In this context, the coefficients of distortion and pressure were looked at in determining the normality of the distribution. Table 10 shows them in detail.

Table 10: Descriptive Statistics of Data Sample

	N	Range	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis
Factor	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Positive	139	2,80	2,20	5,00	4,0935	,64619	**-,452**	,206	**-,362**
Negative	139	2,20	1,00	3,20	1,5971	,60720	**,856**	,206	**-,187**
Negative (Rotated)	139	2,20	2,80	5,00	4,4029	,60720	**-,856**	,206	**-,187**
Valid N (listwise)	139								

In terms of the dimensions of the scale, the Skewness coefficients range from -.45 to .86, and the Kurtosis coefficients range from -.19 to -.36. Because these values are between -1 and +1, the distribution is considered normal (Büyüköztürk, 2014). Then, Z values were examined in determining end values. Z values greater than +3 and less than -3 (Çokluk, Şekercioğlu, & Büyüköztürk, 2014) were considered extreme values and were excluded from the data set.

For EFA, first of all, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test and Bartlett’s sphericity test were carried out. The test results are shown in Table 11. Both the KMO test value of .56 and Bartlett’s test results of [$\chi 2$=187.94; sd=45; p<.01] were found to be significant. These values are where the data is suitable for factor analysis (Büyüköztürk, 2014).

Table 11: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,565
Bartlett's Test of Sphericity	Approx. Chi-Square	187,944
	df	45
	Sig.	,000

According to the factor loads from the EFA result, the first factor of the scale accounts for 19.98% of the total variance, while the second one accounts for 18.41%. Both hold 38.39% of the total variance (see Table 12). The total variance changes from .52 to .72 for the first factor (positive) and from .32 to .80 for the second factor (negative) (see Table 13).

Table 12: Explanation of Total Variance

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings	
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance
1	2,268	22,679	22,679	2,268	22,679	22,679	1,998	19,983
2	1,571	15,709	38,388	1,571	15,709	38,388	1,840	18,405
3	1,310	13,102	51,490					
4	1,045	10,447	61,938					
5	,922	9,220	71,158					
6	,778	7,782	78,940					
7	,646	6,463	85,402					
8	,610	6,099	91,501					
9	,475	4,754	96,255					
10	,375	3,745	100,000					

Table 13: Rotated Component Matrix[a]

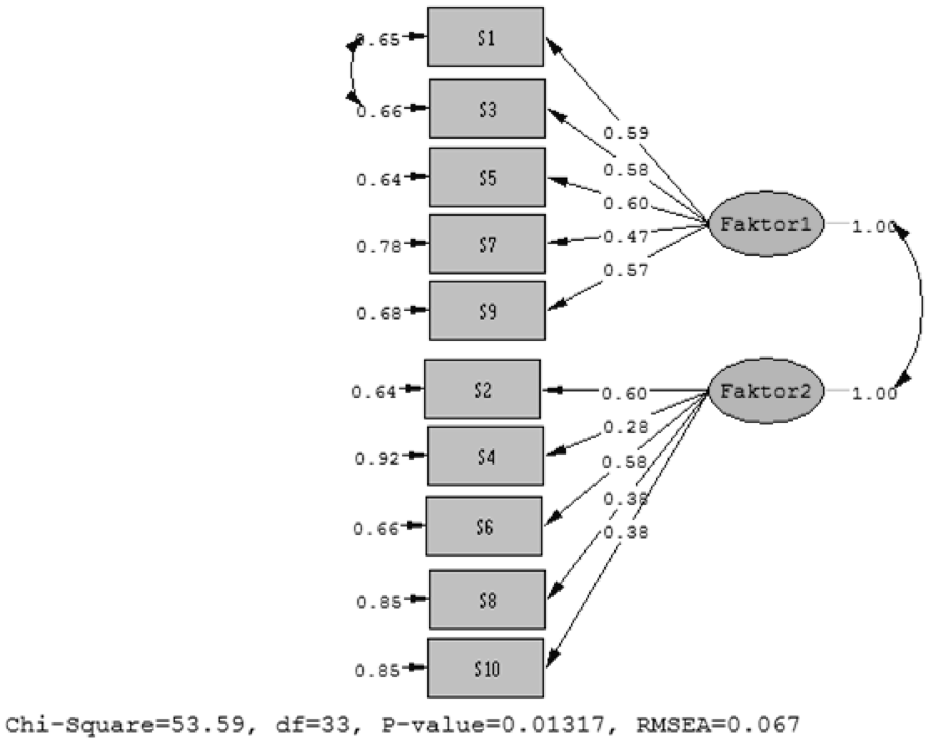
	Component	
Item	1	2
S1	**,575**	-,066
S2	-,146	**,627**
S3	**,523**	-,160
S4	-,067	**,318**
S5	**,679**	-,048
S6	,143	**,803**
S7	**,593**	-,046
S8	-,125	**,568**
S9	**,716**	-,057
S10	-,084	**,584**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

In addition to EFA, CFA was conducted in order to confirm the validation of the two-factorial structure. According to the test results shown in Figure 32, Error Covariance for first item and third item in the first factor were associated with the reasons for the error of the items from the similar reasons. The scale’s Goodness of

Fit Index (GFI)s are x^2/sd=1.62 (x^2=53.59/sd=33), RMSEA=.07, GFI=.93, SRMR=.07, CFI=.90, IFI=.90, NNFI=.86.

Figure 32: CFA Results of the Scale



For reliability of the scale, the item average scores of groups in the upper and lower 27% and the internal consistency coefficient of Cronbach alpha (α) values were inspected. The significant differences between the item average scores of the lower and upper 27% groups (see Table 14) formed according to the factors of the scale show that the items distinguish individuals in terms of measured behavior (Büyüköztürk, 2014). The difference between the lower (M = 3.62, SD =.30) and upper (M = 4.81, SD =.14) 27% groups of all items in the analysis is statistically significant (t (74) = 21.93, p.05) (see Table 15).

Table 14 : Statistics of Groups of the Upper and Lower 27%

	Variable	N	Mean	Std. Deviation	Std. Error Mean
Total	1,00	38	3,6211	,30149	,04891
	2,00	38	4,8158	,14801	,02401

Table 15: Independent Samples Test for the Upper and Lower 27% Groups

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed) p	Mean Difference	Std. Error Difference	Lower	Upper
Total	Equal variances assumed	17,401	,000	21,928	74	,000	-1,19474	,05448	-1,30330	-1,08618
	Equal variances not assumed			**21,928**	53,855	**,000**	-1,19474	,05448	-1,30398	-1,08550

In addition, the Cronbach alpha coefficient calculated for the entire scale is .60. These calculated values show that the scale has reliability.

3.4.4.2. Calculation of the SUS Score of the worDBook App

The SUS scores were calculated by using a technique offered by the researcher (Brooke, 1996). He suggests that the participant respond to all items quickly and that the neglected item be marked with the center point of the questionnaire. He states that SUS delivers one number that represents a compound measure of the overall usability of the aimed product or system; therefore, individual scores of the items do not make sense independently. To get the SUS score, sum up the contributions of each item's score. The score contribution of each item will vary from 0 to 4. The score contribution for items 1, 3, 5, 7, and 9 is equal to the scale position minus 1. The contribution for items 2, 4, 6, 8, and 10 is 5 minus the scale position. To get the total value of SUS, multiply the sum of the scores by 2.5. SUS scores range from 0 to 100.

In accordance with the above calculation, the overall SUS score of the worDBook app was calculated to be 84.89, which is accepted to be "A^{+}" or "Best Imaginable" grade (Sauro, 2018)

CHAPTER 4 - CONCLUSION AND RECOMMENDATIONS

In this section of the study, I will start to discuss the finding and then conclude with some recommendation for researchers, parents, and teachers

4.1. Discussion and Conclusion

This study aimed to suggest a mobile phone application to learners of EFL in Turkey. With this aim, first the subject-related literature was reviewed. Second, the problem was analyzed. After that, the process of the development of the app was planned. Fourth, the plan was implemented. Fifth, the system, the app, was tested on different platforms and, according to the test results, some refinements were made. Finally, a usability test was conducted in order to get users' viewpoints and thereby see whether the worDBook is usable or not.

The use of the word book demonstrates that it is a useful tool that motivates language learners. The study activity enables learners to be exposed to a new word with visual and audio cues, thereby enhancing their retention of the words. Like in the study activity, practice also enables learners to expose the words studied in the study activity again, which enhances retention. In the practice activity, the learner hears the pronunciation of a word and then chooses a picture that matches what she or he hears. If the choice is correct, the learner gets positive feedback, which motivates the learner to continue to complete the activity. At the end of the activity, the learner is given a test result as either some balloons or a bronze cup, silver cup, or gold cup according to his/her test results. This also creates another motivation for the learner to repeat the activities, which causes the learner to expose more words and thus send those words to his or her long-term memory. The learner's vocabulary acquisition process will undoubtedly increase as a result of this integrated learning. Besides distinct studies (Agca & Özdemir, 2013; Ahmad et al., 2015; Castrillo et al., 2014; Gutierrez-Colon Plana et al., 2013; Jalalifarahani & Ghovehnodoushan, 2011; Lawrence, 2014; Stockwell, 2010; Suwanthep & Wang, 2019; Thornton & Houser, 2005; Y. H. Wang & Shih, 2015), the motivation effect of the MALL on users also came out through the worDBook (N=139, M=4,09).

Since the vocabulary was taken from public primary school English books, the app enhances the vocabulary acquisition of those learners who take the same vocabulary at school. As Zhang et al. (2011) states MALL can be more effective through the blended learning approach.

The test process showed the importance of the design of the user interfaces. The more appealing it is, the more learners will pay attention to it. Therefore, the appropriate images, colors, text-sizes, or other visuals or audios should be considered during the development of a new application, especially for young learners. This creates more powerful interaction between the learner and device, and then the learner and content.

The pedagogical aspect of explicit learning and the design aspects of the mobile app were considered in the development of this app. According to researchers (Dörnyei, 2009; Ellis, 1994; Sarıçoban, 2018), the vocabulary learning techniques or strategies may be different. As this study's target group was mainly primary school students, techniques such as grouping, presenting written and oral form, visual encoding, L1 meaning, and repetition were applied to the worDBook for effective vocabulary acquisition. The study brought education and the software engineering discipline together. The functional test results and SUS score show that the mobile application that aims directly at vocabulary learning is a practical tool for learners of EFL.

As a conclusion, worDBook, including text, audio, and pictures, was developed to be a practical tool of vocabulary instruction for new beginners in English language learning, especially for Turkish preschool and primary school students, and as a model for researchers, teachers, and students in education and those in the sphere of MALL. The app allows users to study and practice English vocabulary without any constraints of time and place, and thus may be considered as supplementary tool that help learners continue their learning process outside classroom.

4.2. Recommendations

Using this app proves that MALL can be used to learn new English words or practice existing ones without regard to time or location, which is regarded to be one of MALL's most essential features.

The development process of the app reminds us that, first of all, good planning for the app's development is an important issue. Second, the user interfaces should be created in such a way to attract the learner's attention in order to keep them using the app for a longer time. Third, the visual and audio words that are aimed at teaching should be appropriate to the learner’s level. Fifth, teachers are expected to encourage their students to use this app to enhance their vocabulary acquisition. Sixth, parents of the learners are expected to observe their children during the use of the app and encourage them to repeat the words themselves. Seventh, for a more effective mobile app, it is important to extend the test of the app to more users before finalizing it. Last but not least, new vocabulary apps can be more dynamic by using a dynamic database that may be downloaded when users connect to the internet.

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APPENDICES

Appendix A. Informed Consent Form

Bu çalışmada, **worDBook kelime öğrenimi mobil uygulamasını kullanan öğrencilerin değerlendirmelerinin alınması** amaçlanmaktadır ve bu amaca yönelik birtakım sorular içermektedir. **Araştırmaya katılım tamamen gönüllülük esasına göredir.** Çalışma sırasında uygulanacak testler ve yanıtlamanız gereken sorular, genel olarak kişisel rahatsızlık verecek nitelikte değildir. Araştırmaya katılmayı reddedebilir veya başladıktan sonra devam etmek istemediğinize karar verip yarıda bırakabilirsiniz. Bu hakkınızı kullanmanız durumunda, hiçbir olumsuz tutumla ya da sonuçla karşılaşmayacaksınız. Elde edilen bilgiler yalnızca araştırmacı tarafından değerlendirildikten sonra bilimsel maksatlı kullanılacaktır.

Anketi ilk sorudan başlayıp, yönergelere uyarak sırayla yapmanız çok önemlidir. Çalışmanın veri toplama aşamasının sonunda, bu çalışmayla ilgili sorularınız cevaplanacaktır.

Verdiğiniz bilgiler kesinlikle gizli tutulacaktır. Lütfen adınızı kitapçığın hiçbir yerine yazmayınız. Kitapçığın yanıtlanması yaklaşık 5-10 dakika alacaktır. Bu ölçekleri doldurmanın bilinen hiçbir riski bulunmamaktadır

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Appendix B. SUS-TR Questionarie

“worDBook” Mobil Kelime Öğrenimi Uygulaması Kullanılabilirlik Ölçeği

Bu anket, Önerilen Bir Mobil Kelime Öğrenimi Uygulaması: worDBook başlıklı Selçuk Üniversitesi'nde (Konya-Türkiye) yürütülen tez çalışmasının bir parçası olarak worDBook uygulamasını kullanan ilkokul öğrencilerinin uygulama hakkındaki görüşlerini toplamaktadır.

Bu çalışmayı tamamlamak için değerli katkınıza ihtiyacım var ve bu on maddelik anketi doldurabilirseniz memnun olurum. Lütfen istemiyorsanız yapmak zorunda olmadığınızı unutmayın. Adınız sorulmayacak, cevaplarınız gizli kalacak ve sadece araştırma amaçları için kullanılacaktır. Değerli desteğiniz için çok teşekkür ederim.

Sistem Kullanılabilirlik Ölçeği	**Hiç katılmıyorum**	**Kısmen katılıyorum**	**Ne katılıyorum ne katılmıyorum**	**Katılıyorum**	**Tamamen katılıyorum**
	1)	**2)**	**3)**	**4)**	**5)**
1. Bu uygulamayı sıklıkla kullanmak isteyeceğimi düşünüyorum.					
2. Bu uygulamayı gereksiz bir şekilde karmaşık buldum.					
3. Bu uygulamanın kullanımının kolay olduğunu düşündüm.					
4. Bu uygulamayı kullanabilmek için daha teknik bir kişinin desteğine ihtiyaç duyacağımı düşünüyorum.					
5. Bu uygulamadaki çeşitli işlevleri iyi birleştirilmiş buldum.					
6. Bu uygulamada çok fazla tutarsızlık olduğunu düşündüm.					
7. Birçok insanın bu uygulamayı kullanmayı çok çabuk öğreneceğini sanıyorum.					

8. Bu uygulamanın kullanımını çok elverişsiz buldum.					
9. Bu uygulamayı kullanırken kendimden çok emin hissettim.					
10. Bu uygulamada bir şeyler yapabilmek için öncelikle birçok şey öğrenmem gerekti.					

Kaynak: SUS-TR (Demirkol ve Şeneler , 2018, s. 252-253) ölçeğinden uyarlanmıştır.

Appendix C. Parents' Consent Form in Turkish

Sayın Veli;

Çocuğunuzun katılacağı bu çalışma, "Önerilen Bir Mobil Kelime Öğrenimi Uygulaması: worDBook" adıyla, 06-16 Şubat tarihleri arasında yapılacak bir araştırma uygulamasıdır.

Araştırmanın Hedefi: Öğrencilerin okulda İngilizce dersinde öğrenmeye çalıştıkları İngilizce kelimelerini tekrar etmelerini sağlayan worDBook uygulamasına yönelik görüşlerinin alınmasıdır.

Araştırma Uygulaması: Anket şeklindedir.

Araştırma T.C. Milli Eğitim Bakanlığı'nın ve okul yönetiminin de izni ile gerçekleşmektedir. Araştırma uygulamasına katılım tamamıyla gönüllülük esasına dayalı olmaktadır. Çocuğunuz çalışmaya katılıp katılmamakta özgürdür. Araştırma çocuğunuz için herhangi bir istenmeyen etki ya da risk taşımamaktadır. Çocuğunuzun katılımı tamamen sizin isteğinize bağlıdır, reddedebilir ya da herhangi bir aşamasında ayrılabilirsiniz. Araştırmaya katılmamama veya araştırmadan ayrılma durumunda öğrencilerin akademik başarıları, okul ve öğretmenleriyle olan ilişkileri etkilemeyecektir.

Çalışmada öğrencilerden kimlik belirleyici hiçbir bilgi istenmemektedir. Cevaplar tamamıyla gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir.

Uygulamalar, genel olarak kişisel rahatsızlık verecek sorular ve durumlar içermemektedir. Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden çocuğunuz kendisini rahatsız hissederse cevaplama işini yarıda bırakıp çıkmakta özgürdür. Bu durumda rahatsızlığın giderilmesi için gereken yardım sağlanacaktır. Çocuğunuz çalışmaya katıldıktan sonra istediği an vazgeçebilir. Böyle bir durumda veri toplama aracını uygulayan kişiye, çalışmayı tamamlamayacağını söylemesi yeterli olacaktır. Anket çalışmasına katılmamak ya da katıldıktan sonra vazgeçmek çocuğunuza hiçbir sorumluluk getirmeyecektir.

Onay vermeden önce sormak istediğiniz herhangi bir konu varsa sormaktan çekinmeyiniz. Çalışma bittikten sonra bizlere telefon veya e-posta ile ulaşarak soru sorabilir, sonuçlar hakkında bilgi isteyebilirsiniz. Saygılarımızla,

Araştırmacı :

İletişim bilgileri :

Velisi bulunduğum .... sınıfı .... numaralı öğrencisi ....'in yukarıda açıklanan araştırmaya katılmasına izin veriyorum.
(Lütfen formu imzaladıktan sonra çocuğunuzla okula geri gönderiniz*).

...../02/2022

İsim-Soyisim İmza:

Veli Adı-Soyadı :

Telefon Numarası :