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**EFFECTIVENESS OF USING DIGITAL FLASHCARDS
APPLICATION ON INTERNATIONAL UNIVERSITY
STUDENTS' VOCABULARY MASTERY AND PERCEIVED
SATISFACTION**



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**MASTER OF SCIENCE (MULTIMEDIA STUDIES)
UNIVERSITI UTARA MALAYSIA
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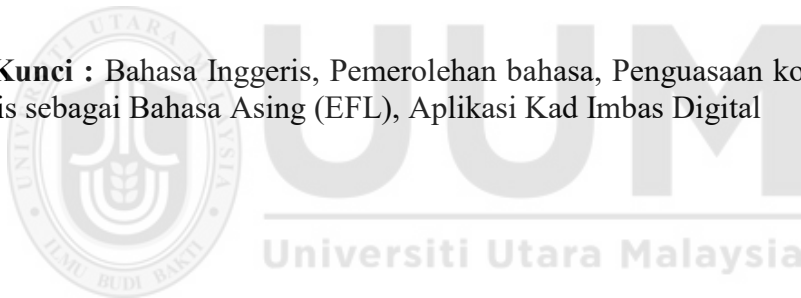
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Abstrak

Kosa kata sering diabaikan walaupun merupakan salah satu aspek penting dalam pemerolehan bahasa. Disebabkan kurang penekanan terhadap pembelajaran kosa kata, pelajar Bahasa Inggeris sebagai Bahasa Asing (EFL) menghadapi masalah dalam pembelajaran bahasa Inggeris secara efektif sehingga menyebabkan tahap penguasaan bahasa yang rendah. Justeru, kajian ini bertujuan untuk membangun dan menilai kesan aplikasi kad imbas digital (DFA) kepada pelajar universiti dari luar negara dalam meningkatkan penguasaan kosa kata Bahasa Inggeris dan persepsi kepuasan mereka. DFA telah direka bentuk dengan menggabungkan prinsip pembelajaran multimedia dan teknologi pemujuan. Prototaip ini telah direka bentuk dan dibangun berdasarkan model reka bentuk pengajaran Alessi dan Trollip. Kajian ini dijalankan di sebuah universiti awam di Malaysia, bersama pelajar yang mempelajari Bahasa Inggeris sebagai bahasa asing. Saiz sampel ialah 35 peserta ($N=35$). Satu set ujian pra dan pasca telah dijalankan untuk menilai prestasi mereka sebelum dan selepas menggunakan DFA. Skor untuk kedua-dua ujian dianalisis menggunakan statistik deskriptif, ujian-t sampel tidak bersandar dan ujian-t sampel berpasangan. Dapatan analisis menunjukkan pelajar yang menggunakan DFA mencapai markah yang lebih tinggi secara signifikan dalam ujian pasca berbanding ujian pra. Kajian ini membuktikan penggunaan DFA memberi hasil positif kepada pelajar dalam meningkatkan penguasaan kosa kata bahasa Inggeris dan persepsi kepuasan mereka.

Kata Kunci : Bahasa Inggeris, Pemerolehan bahasa, Penguasaan kosa kata, Bahasa Inggeris sebagai Bahasa Asing (EFL), Aplikasi Kad Imbas Digital



Abstract

Vocabulary is often neglected despite being one of the most crucial aspects of language acquisition. Due to lacking of emphasis on the vocabulary learning, English as Foreign Language (EFL) students face issues in effectively learning the English language, which results in low-level language proficiency. Hence, this study aimed to develop and investigate the effect of a Digital Flashcard Application (DFA) on foreign university students in improving their English vocabulary mastery and perceived satisfaction. The DFA was designed by integrating multimedia learning and persuasive technology principles. The prototype was design and developed based on Alessi and Trollip instructional design model. The study was conducted at a public university in Malaysia, with students who learn English as a foreign language. The sample size was 35 participants (N=35). A set of pre-test and a post-test were administered to appraise their performance before and after using the DFA. The scores for both tests were analyzed using descriptive statistics, independent sample t-test, and paired sample t-test. The analysis finding revealed that students who used the DFA achieved a significantly higher score in the post-test compared to the pre-test. This study has proved that the use of the DFA has positive results on students in improving their English vocabulary and perceoved satisfied.

Keyword: English language, Language acquisition, Vocabulary mastery, English as Foreign Language, Digital Flashcard Application



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In the name of Allah, the Beneficent, the Merciful Praise be to Allah, Lord of the worlds, finally this thesis has been completed.

This thesis would not have been possible without the guidance and help of several individuals that contributed their valuable supports and assistance for this success. Firstly, I would like to express my utmost gratitude to my supervisor, Ts. Dr Azliza bt Othman for her expertise, generosity, patience, and encouragement in supervising me to achieve this success. Under her excellent supervision, the preparation of the thesis has been both enjoyable and challenging. I would also like to thank my co-supervisor, Dr Yusrita binti Mohd. Yusoff, for her precious knowledge and assistance on this thesis development. My sincere appreciation also goes to all my family members for their immeasurable supports. Last but not least, I would like to share my gratitude and thanks to my friends and my research colleagues and others for the supports and encouragement in achieving this Master (by Research) degree.

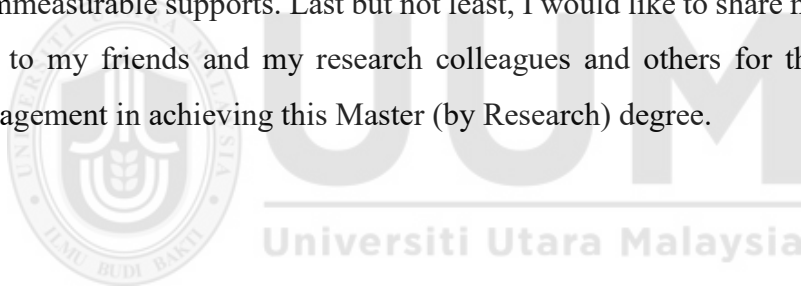


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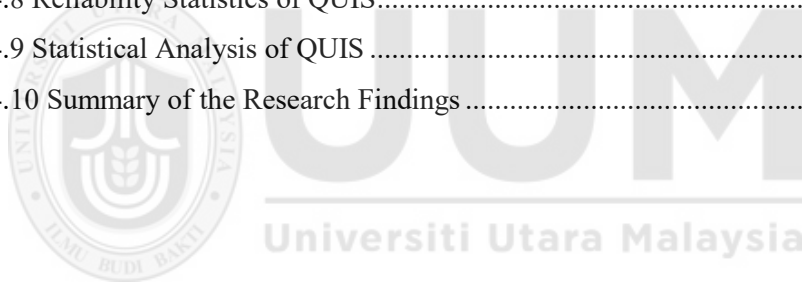
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Glossary of Terms

<Delete if not applicable>



List of Abbreviations

DFA	Digital flashcards Application
IEP	Intensive English Program
EFL	English as a Foreign Language
ESL	English as a Second Language



CHAPTER ONE

INTRODUCTION

1.1 Background of Study

What does language mean? "A social phenomenon which is part of the natural history of human beings; a sphere of human action, wherein people utter strings of vocal sounds, or inscribe strings of marks, and wherein people respond by thought or action to the sounds or marks which they observe to have been so produced" (Lewis, 1975 p. 3).

The English language has turned into the most broadly utilized language in global communication (Spolsky & Shohamy, 1999). English has long been recognized as a global language, spoken by many people all over the world. English has been used for communication and interaction with other people who use different languages—because of that, learning English has turned into an essential education plan and policy in several countries that do not speak English (Wu and Huang, 2017).

Vocabulary learning is a critical aspect of language development because it supports four fundamental language skills: reading, speaking, listening, and writing. The more words the learner gets, the more they can communicate. Students must acquire many words or vocabularies and know how to use them exactly (Syarif & Fitrawati, 2016). To be good in English, four fundamental language skills are needed to be developed: reading, speaking, listening, and writing (Nam, 2010). Azabdaftari and Mozaheb (2012) noted that vocabulary assists in developing the four language skills of listening, speaking, reading, and writing and acts as a bridge between EFL students and content-

area classes. Students frequently encounter an impediment to studying due to a lack of language knowledge.

Without an adequate vocabulary, second and foreign language learners will not communicate effectively with others or express their thoughts and feelings; additionally, it helps with the comprehension of written and spoken text. Having a good command of vocabulary in a foreign language is essential for students to write well-structured texts and grasp the pronunciation of the language. Understanding the functions of words and how they can be used in various situations and contexts is essential for expanding one's vocabulary (Viera, 2017).

The teachers utilize several standard techniques and strategies to enhance vocabulary learning, such as wordlists and flashcards. Flashcards are mainly used as a teaching aid when teachers want to introduce new words. Flashcards are a group or set of cards containing a single word, phrase, or image. These strategies can help students enhance their capacity to express themselves in a variety of situations and circumstances (Azabdaftari & Mozaheb, 2012).

According to Mayer's multimedia principle, people learn more effectively from text and images rather than just text (Mayer, 2001). Multimedia applications have significant influences on people and affect teaching and learning processes. It can help students in their educational environment, particularly language study (Mayer, 2001). This study integrated multimedia principle and similarity principle into designing

digital flashcards of English vocabulary learning for English Foreign Language (EFL) intensive class students.

It is generally accepted that incorporating technology into language instruction has profoundly affected language learning (Amine & Benachaiba, 2012). They also stated that multimedia had become highly regarded as teaching aid for English with the advancement of technology. Additionally, many English teachers agree that incorporating multimedia into the English classroom can help students learn more effectively and more efficiently (Yang and Fang, 2008). Therefore, there is a need to introduce new strategies by utilizing current multimedia technology for vocabulary learning.

Multimedia has been effectively applied in many courses to motivate and offer various learning styles (Gilakjani, 2012). According to Acha (2009), an appropriate combination of multimedia and teaching methodology can draw the attention of English Foreign Language (EFL) students to English language learning. Zhen (2016) also agreed that education needs to be modernized in a society rapidly, and multimedia is an essential feature in modern education. Zhen also admitted that multimedia does make a revolutionary impact on language teaching.

Mostly, digital flashcards are invented to replicate traditional flashcards. Users can perform similar tasks with digital flashcards, such as making individual cards with images and text; practising with cards, printing paper-based card versions; and exchanging the cards with other users (Tim and Baynard, 2010). Recent, with the rise

of mobile applications and smartphones, Apps are designed to encourage studying, like flashcard apps (Shelly, Gunter & Gunter, 2013). Digital flashcards are seen as a valuable tool that can assist individuals in recalling information such as formulas of mathematics, the vocabulary of terms, details of history and complicated medical terminology (Charles and Stephen, 2014). According to researchers, digital flashcards have several advantages over traditional flashcards and are an effective alternative method for learning vocabulary (Hung, 2015; Azabdaftari & Mozaheb, 2012).

1.2 Preliminary Investigation

A preliminary investigation (PI) was made to explore the existing issues regarding students' lack of performance and motivation when studying English vocabulary. A qualitative approach was adopted, utilizing semi-structured interviews. Interview questions are included in Appendix A. Using this strategy, data was gathered and enriched by direct contact with the subject matter experts (SMEs).

The interview took place with the Intensive English Program (IEP) lecturer, an English as a Foreign Language (EFL) specialist with more than five years of expertise. The findings and transcript of this preliminary investigation, as described in detail in Appendix B, indicated a lack of performance and motivation in the mastery of English vocabulary. The expert agreed that lack of vocabulary is a problem. She said that students could not speak English because they did not have enough vocabulary due to less of reading books that lead to look up to dictionaries. As known, both are effective traditional learning English methods (Riahipour & Saba, 2012). Currently, expert highlight that she uses vocabulary memorising, understanding vocabulary from the

context of the text, filling in the blanks and looking up dictionaries as methods in teaching IEP students.

Besides, she claims that digital and computer technology such as using app, tool, and software is vital to help teaching and learning English more effectively to reinforce vocabulary acquisition. Therefore, learning tools can be designed and developed using suitable multimedia elements and computer technology to support vocabulary acquisition. It is also essential to use the benefits of digital and computer technology to help the teaching and learning English more effectively to improve vocabulary mastery among international students in UUM.

1.3 Problem Statement

Four primary language abilities must be mastered in order to be fluent in English: writing, reading, listening and speaking. Vocabulary learning is a critical component of language development since it supports these four language skills. The more words the learner gets, the more they can communicate. Nam (2010), as cited by Azabdaftari and Mozaheb (2012) noted that vocabulary assists in developing the four language skills of listening, speaking, reading, and writing and acts as a bridge between EFL students and content-area classes.

Based on the preliminary investigation findings, the expert agreed that lack of vocabulary is a problem in learning English. The finding in PI coherent with study conducted by Oliver and Young (2016). The author highlights that despite learning English for a long time, most foreign English language students encounter many

challenges in learning English. This is because they have a limited range of vocabulary, which affects both reading comprehension and education in general. Other study stated that the students could not speak, listen, read, or write in English if they had a substantial vocabulary (Mohammadnejad & Nikdel, 2012). Vocabulary acquisition in learning a second or foreign language can be one of the most challenging aspects of learning a new language (Lin et al., 2013; Bin-Tahir, 2015; Hanapi, 2017; Hassan & Abubakar, 2015). It is claimed that, sometimes, students might become frustrated as English becomes an obstacle for their learning process and the difficulty of the content itself (Buitrago, 2017).

The expert also said that students do not use traditional learning methods such as reading books and looking up dictionaries. In addition, the currently methods used in teaching IEP students are vocabulary memorising, understanding vocabulary from the context of the text, filling in the blanks and looking up dictionaries. Few studies that concentrated on the traditional techniques such as memorizing long vocabulary lists, derivations, repeating words, translation and blank filling exercises in teaching and learning vocabulary. Unfortunately, Riahipour and Saba (2012) found these methods are ineffective in motivating students to learn vocabulary. Yip and Kwan (2006) exhibited that teaching vocabulary of the second language is a difficult job and needs a lengthy process. Therefore, there is a need to motivate these students to acquire more vocabulary by utilizing effective methods to master the English language. However, these current vocabulary learning techniques are often considered dull by learners, particularly those who have grown up in the digital era (Florence & Alvin, 2007; Amine & Benachaiba, 2012).

Thus, the expert claims that to enhance vocabulary learning, the use of digital and computer technology is essential to assist the teaching process more effectively. The students be frustrated and lose self-confidence if they do not obtain proper strategies to acquire new vocabulary (Nation, 2013). Since learning vocabulary requires text only, it is difficult for learners to understand. Although today's learners consider traditional learning styles as boring, modern learning environments that exploit multimedia are commonly accepted. The vocabulary being the basis of language learning, many studies have attempted to identify useful activities for a language learner interested in long-term vocabulary knowledge (Icht & Mama, 2022).

According to Mayer's multimedia principle, people learn more effectively from text and images rather than just text. Multimedia-based learning application significantly affect individuals and impact teaching and learning processes; this could help learners in their learning environment, including learning languages. In many courses, multimedia has shown to be a motivating and a wide diversity of learning methods (Gilakjani, 2012). According to Acha (2009), an appropriate combination of multimedia and teaching methodology can draw the attention of ESL students to English language learning. Zhen (2016) also agreed that it is immediate that education needs to be modernized in a society, and multimedia is an essential feature in modern education. Zhen also admitted that multimedia does make a revolutionary impact on language teaching.

It is generally accepted that integrating technology into language instruction has had a massive impact on language learning (Amine & Benachaiba, 2012). They also stated that multimedia had become highly regarded as an advancement of technology to teach English. Additionally, many English teachers agree that incorporating multimedia into the English classroom can help students learn more effectively and more efficiently (Yang & Fang, 2008). Therefore, there is a need to introduce new strategies by utilizing current multimedia technology for vocabulary learning.

According to Azabdaftari and Mozaheb (2012), the teachers utilize several standard techniques and strategies to enhance vocabulary learning, such as wordlists and flashcards. Flashcards are mainly used as a teaching aid when teachers want to introduce new words. Flashcards are a group or set of cards containing a single word, phrase or image. Using these methods, teachers may help students better express their thoughts and feelings in various circumstances and situations. Based on finding in the PI, students face difficulty in understanding and speaking English language due lack of vocabulary. Based on literature review finding, and traditional methods used in teaching vocabulary dull. It is shows that there is a need to introduce a new teaching strategy by utilizing current multimedia technology for vocabulary learning. In this study, the design of digital flashcards, the multimedia principle and the principle of similarity were integrated to improve student vocabulary mastery and perceive satisfaction.

1.4 Research Objectives

The main objective of this study is to develop a Digital flashcards Application (DFA) to improve vocabulary mastery among international students in UUM. To achieve the main objective, the following sub-objectives were identified:

1. To identify requirement of components for the design and development of the DFA.
2. To design and develop of the DFA.
3. To investigate the effectiveness of the DFA on the International university students' vocabulary mastery.
4. To evaluate the effectiveness of the DFA on the International university students' perceived satisfaction.

1.5 Research Questions

1. What are the requirement of components for the design and development of the DFA?
2. What are the process that are involved to design and develop the DFA?
3. What is the effectiveness of the DFA on the International university students' vocabulary mastery?
4. What is the effectiveness of the DFA on the International university students' perceived satisfaction?

1.6 Research Hypotheses

This study examines the effect of DFA on the vocabulary acquisition of international students of English. The hypotheses are:

Ho1. There is no significant improvement on the student vocabulary mastery after using DFA.

Ho2. There is no significance changes on the student's perceived satisfaction after using the DFA.

1.7 Significance of the Study

The study helps to improve of students' English vocabulary acquisition by using the DFA. Predictably, the study's findings will mainly contribute to the undergraduate international students of Universiti Utara Malaysia (UUM). The DFA developed in this study could provide the teacher with comprehensive and alternative teaching methods, particularly in teaching English language vocabulary for the students. The current study sheds light on the use of DFA to encourage students to recognize and recall words easily and improve teaching and learning style. Students will be more confident to learn once they correctly understand what they have remembered.

The proposed DFA design and development process will help multimedia specialists or developers in the design and development of multimedia learning applications, specifically mastering English vocabulary. This study combines macro strategy (persuasive principles) and micro approach (Multimedia principle). Furthermore, this study also helps to bring new insights to the CTML design theory. This study examined the effects of the multimedia principle on students' English vocabulary

mastery and perceived satisfaction. The multimedia principle describes that people learn more effectively from text and images rather than just text (Mayer, 2009). This study established that multimedia principles can affect international students' English vocabulary mastery and perceived satisfaction in the range of DFA.

1.8 Limitations of the Study

This study's findings can be generalized however it has a few limitations. This study is confined to the IEP students, and the instruction language used in the (DFA) will be in the English language and based on the Intensive English Program module. The respondents involved in the study are confined to the undergraduate international students of Universiti Utara Malaysia (UUM).

1.9 Theoretical Framework

This study's theoretical framework is dependent on a macro and micro design strategy to ensure that this study is systematically conducted (Reigeluth & Merrill, 1978). As defined by Reigeluth and Merrill, Macro strategy entails the selection, sequence, and organization of the subject matter to be represented. In addition to the macro strategy, the micro strategy focuses on how to deliver the learning content efficiently. In that context, this study considers persuasive technology as the macro strategy (Fogg, 2003). Multimedia Principle (Mayer, 2009) is chosen as the micro strategy which is based on Mayer's Cognitive Theory of Multimedia Learning (Mayer, 2001).

The design strategies for this study are depicted in Figure 1.1. Additionally, a brief discussion of the theories is included in this chapter and is expanded upon in Chapter 2.

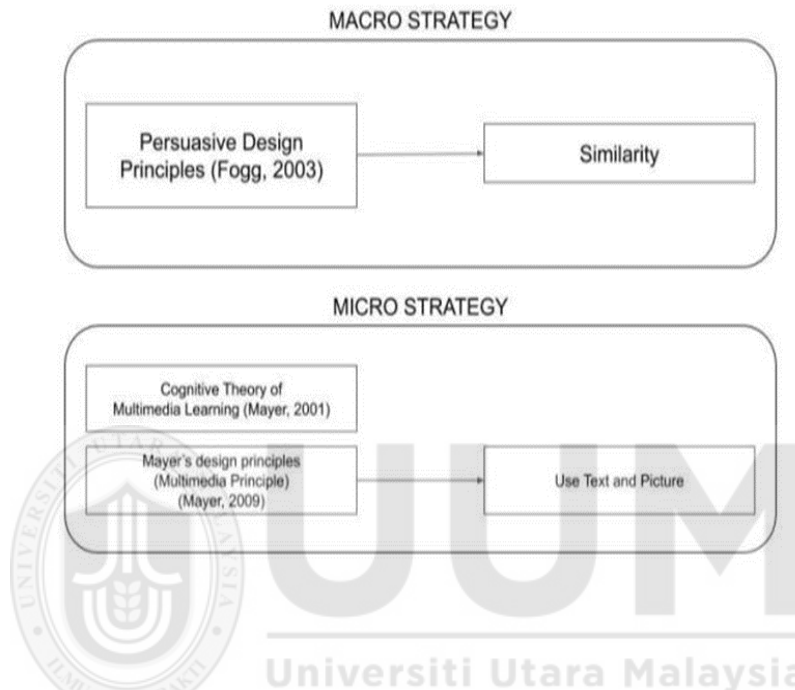


Figure 1.1. Visual Representation of the Theoretical Framework

According to Fogg's Principle of Similarity, this is the same thing in technology. As a result, when designing a product, a designer may make their technology or product more appealing by designing it for a specific audience. The more users can recognize the product, the more likely they are to be persuaded to alter their attitudes or behaviours as indicated by the product. As a result, the similarity principle is used in the design (DFA) using similar content and learning circumstances. Furthermore, DFA's metaphors are ensured by mapping learners' familiar environments such as books and flashcards.

1.10 Research Framework

The research context of this study is graphically depicted in Figure 1.2. One independent variable that seeks to affect two dependent variables is proposed in the study context. The independent variable will display a significant difference between the dependent variables. Meanwhile, English vocabulary mastery and perceived satisfaction are dependent variables.

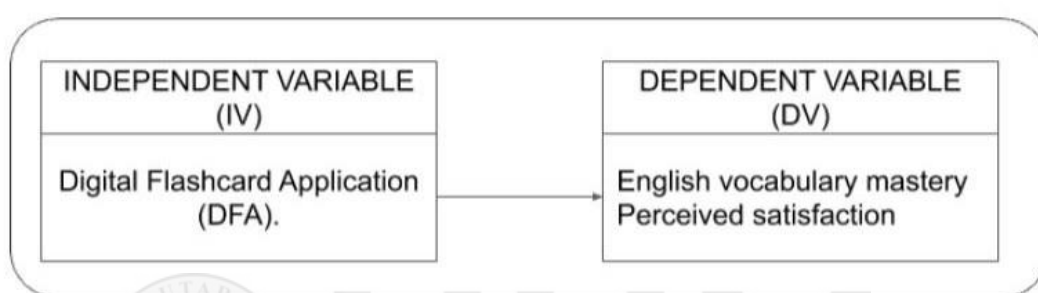


Figure 1.2. *Graphic Representation of the Research*

1.11 Summary

The chapter explains the background of the study, preliminary investigations, problem statements, research objective, research questions, research hypothesis, theoretical framework, research framework, the significance of the study and research limitations. The purpose of this study is to evaluate the effects of DFA on foreign students' English vocabulary mastery and perceived satisfaction in learning English vocabulary. The next chapter discusses literature reviews that are linked to this research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to show the literature review on the use of DFA in teaching English language vocabulary among foreign students in UUM. It reviews past and contemporary literature on using DFA in teaching English language vocabulary among international students in UUM. Learning theories and strategies used for education have been discussed throughout this chapter. This chapter shows the related theories reviewed in the topic studied.

2.2 English Language

Nowadays, English has a significant impact on the world. The majority of individuals use it to communicate with one another. They use English to interact, advertise, broadcast, and travel. As a result, people require it to accomplish their life goals, including those related to education (Suhaimi, 2014).

2.2.1 Importance of English Language

English is now the most commonly used language in global communication (Spolsky & Shohamy, 1999). English has been widely acknowledged as an international language, spoken by a large number of people in most parts of the world. English has been used for communication and interaction with other people who use different languages because of that, Learning English has become a critical component of several non-English speaking countries' educational strategies and policies (Wu and Huang, 2017).

From a practical perspective, English has spread widely among non-native speakers. Many countries in Asia, Africa, the Pacific, and other countries identify it as an official, associated official language or job. Given the situation, millions of students have learned English as a language of communication. Based on a survey conducted by Japan's National Language Institute in 1999, people worldwide agreed that English was the most helpful language for global communication (Honna, 2016).

Agca and Özdemir (2013) stated that the significance of taking in the English language, which is the common correspondence language of the general public for nations that have distinctive language, had been enhanced as of late. Over the years, English has been one of the most spoken languages globally, earning the reputation of a global language. Due to shifts in economic and political ties between developing countries, English became an official language and used informal talks at conferences organized by international organizations. In addition, there has been a need for communication in a global language due to scientific and technological innovations. As a result, English has spread across the globe to achieve this goal. Most Asian countries realize that the English language is necessary for international communication; they are particularly committed to improving and encouraging the teaching and learning of the English language (Honna, 2016).

2.2.2 Learning English in Malaysia

According to Thirusanku and Yunus (2012), several nations once colonized by the United States or the United Kingdom, including Malaysia, India, Nigeria, and the Philippines, have adopted English as their second language and use it widely. Malaysia

is one of the Asian nations that has implemented a dual education system; the purpose is to find a balance between national and global educational standards and concerns (Gill & Kirkpatrick, 2013).

In the educational system of Malaysia, a formal style of learning English as a second language is carried out in the classroom (Gill, 2002). Following educational policy, The English language becomes a required subject at all stages of education, which implies its existence (Thirusanku & Yunus, 2012).

According to Omar (1992), English was introduced to the education system in Malaysia during the British colonial period (during the 1960s). Today, it remains part of the Malaysian educational system. Malaysian schools have made English a mandatory subject for primary and secondary students. At the next level, undergraduates must complete a specified number of credit hours of English courses. This is based on their Malaysian University English Test (MUET) result. The MUET measures a person's English language competency and is a prerequisite for those who seek to pursue higher education in Malaysian institutions (Malaysian Examination Council, 2006). The international students studying at universities must go through the Intensive English Program (IEP) (Sundram, 2017).

English is expanding in its purpose from its limited use for education and official records. As such, the role of the English language is extended to include other circumstances, not just as the official language and in the official documentation. A notable policy change has been the shift of English for other knowledge areas such as technology and science. Overall, this section serves as background information on

how English is considered a second language in Malaysia, and ESL schools are available for students from many nations.

Compared to previous English language teaching, teaching modern English in college has practical and effective features, and it is easy to be comprehended by students. To assist students in learning English in everyday life and alleviate the strain, it is essential to separate it into secondary subjects such as vocabulary, grammar, and reading (Wang, 2016).

2.2.3 Challenges in Learning English as Foreign Language

Acquiring the English language is never easy, especially when learning English outside of an English-speaking country. English learners in countries like Yemen, Thailand, China, and elsewhere in Asia encounter several difficulties because English is not their first or official language. The following difficulties that English learners often face:

i. Problems on the part of the teachers

According to Ghorbani (2009), "Many teachers help students cope with examinations to preserve their reputation as good teachers" (p. 51). Teachers' remorse, humiliation, or embarrassment about their students' poor performance on public examinations leads them to limit their English instruction to test preparation (Alderson & Wall, 1993). Nowadays, regrettably, most teachers don't give the four language skills equal importance. The most careless of the four foreign language teaching skills is speaking. (Akbari, 2015).

ii. Problems on the part of the limited learning environment and material

Most students only try to speak English in class only when under supervision, and even then, they may not hear other students around them using the language; because of this, learning English becomes more difficult. Learning English might be difficult for people who have never had a chance to immerse themselves in their native language. However, the English language has little practical use outside of the classroom, and hence they have no interest in learning it (Akbari, 2015).

Teaching material refers to the elements that facilitate the learning process. English language textbooks material appears to assume an imperative role in the educational system of each nation (Akbari, 2015). Books can be a needful material, but they are not enough. Textbooks can be a valuable asset for independent learning and presentation of content, concepts and activities, a reference source for students, a curriculum representing predetermined learning goals and assistance for much less qualified teachers (Tsiplakides, 2011).

In crowded schools, when it comes to foreign language proficiency, most pupils cannot overcome their language learning challenges since they don't have a set amount of time allotted for each work. They cannot develop their favorite English language skills like listening and speaking because of a lack of time in the classroom (Akbari, 2015).

iii. Problems on the part of the students

Because English isn't a priority for students, they focus on other topics instead. Not every student is motivated or aspires to learn English in the same way; some believe English is a course that needs to be passed, and they do not recognize its significance as a medium of communication through which for most students, learning English is a thing they need to do; however, they don't like to do it. Because there is no interest in learning English, these students are not very encouraged to participate in the class and are effectively trying to have a pass rating to get rid of the course (Akbari, 2015).

In most cases, students learn the English language only in class when the teacher is there; after class, they put down their books and wait for the next lesson. The lack of motivation on the part of students is another reason for not paying much attention to language. The intention to pass the exam must be eliminated, and effective learning must be done with the help of teachers who teach the language (Priya, 2016).

iv. Problems on the part of the vocabulary

Learning English, according to some students, consists of memorization of vocabulary and grammar rules (Oxford, 2000). Pinter (2006) highlighted that ESL readers rely heavily on vocabulary, and the absence of such knowledge is the primary and most crucial impediment to their success.

According to Rohmatillah (2014), the students still have difficulties learning English language vocabulary. These difficulties encountered by students in learning vocabulary are multiple, such as:

1. Students have difficulty pronouncing words.
2. Students have problems with writing and spelling.
3. The many grammatical forms of a word, referred to as inflexions, contributed to students' difficulty acquiring vocabulary.
4. Choosing the appropriate meaning of the words.
5. Students continue to be perplexed about how to utilize the word in context.
6. Students were also still confused when they found idiomatic words or expressions.
7. The form of writing and speaking is different in English,
8. The words that students need to learn are huge numbers.
9. The source limitations are about words information.
10. The difficulty of knowing words which implies much more than knowing the dictionary's definition.
11. Lack of understanding of words grammar.
12. The wrong pronunciation.

2.2.4 Vocabulary

Vocabulary is considered fundamental to successfully learning a foreign language (Schmitt, 2013). According to Syaifudin (2017), vocabulary is one of the most noticeable elements of any language; a language's vocabulary is a list of groupings of

words and phrases, often arranged alphabetically. Hornby (1974) mentioned that vocabulary is the set of words that form a language. Students with a solid vocabulary base can encounter a quickened expectation to absorb information in later phases of language learning and master oral comprehension, speaking, reading and writing skills (Buitrago, 2018). The more vocabulary the learner understands, the more skilful expressions can use. Regarding learning English as a foreign language, students with limited vocabulary have problems with the language (Lin, 2018).

Neuman and Dwyer (2009) mentioned that there are two types of vocabulary that we require to communicate effectively: expressive vocabulary (words we use while speaking) and receptive vocabulary (words we hear when listening). These words permit us to clear our thoughts of the world and express our thoughts, in the meantime through our inner vocabulary, we can understand the essence of someone else's speech. According to Richards (2002), Vocabulary is a fundamental aspect of language understanding, as is the capacity of students to speak, listen, read, and write.

Tamayo, Gaviria and Rivas (2016) described vocabulary as words that we'd like to recognize to communicate effectively. In other words, vocabulary plays an essential part in learning and productive skills. Hatch and Brown (1995) stated that the vocabulary of a language is its essential structure, and it plays a critical role in communication. They described that they could convey their ideas and get what other people say by mastering the vocabulary.

Based on the definitions before, it seems that the term "vocabulary" refers to the whole amount of words that anticipated that would confer musings and express the speaker's significance. That is the inspiration driving why it is fundamental to learn vocabulary (Alqahtani, 2015).

2.3 Multimedia

Multimedia refers to a combination of computer hardware and software that use all the five elements of multimedia which text, graphic, audio, animation, and video, to produce a good presentation in many aspects such as education, business, media and others (Hofstetter, 2001; Vaughan, 2004). For many years, the multimedia concept has been defined in a variety of ways depending on the researcher's interests, the field of study, and the purpose. In this study, Multimedia is seen as the most effective method of introducing material to an audience. The accompanying subsections clarify the interactive media definition, including definitions, components and multimedia learning (Azliza, 2015).

The multimedia term combines text, graphics, video, animation and sound into a presentation or interactive application to transfer content or information to an audience (Allessi & Trollip, 2001). Multimedia combines two or more: text, picture, sound, voice, video and computer programs. These elements are controlled digitally by a computer. To transfer an idea, that can use multimedia to communicate the message.

2.3.1 Elements of Multimedia

According to Shank (2005), effective multimedia learning demands a wise combination of means in a reasoned way that takes preference of the unique characteristics of each element. Each element has its role and will assist in producing an enjoyable and efficient presentation of information. This part covers the aspects related to multimedia, namely, text, graphics, animations and sound used for the design of the DFA.

i. Use of text

It is a commonly acknowledged component of any interactive multimedia learning; the text exists in different types: a word, a single line, or a paragraph, as the text plays a significant role in communication (Hofstetter, 2001). Therefore, designers must consider text design problems dependent on the function of the text in the interactive media application they develop. The text might not be approximately the same size, type, colour and style that meets the expert specifications of the multimedia software. In this study text is consider as essential and main element in display content of DFA.

ii. Use of graphic

In a multimedia presentation, the graphics can be filled in as a link icon, object, combined with text, displaying choices that can be chosen or shown in full screen instead of text, with parts of the image that serve as a snapshot, or sent to other multimedia objects or occasions (Hofstetter, 2001). Graphic is used in this study as supporting multimedia element to illustrate vocabulary term.

iii. Use of audio

Audio or sound is a form of regular use for lessons and online learning; audio could be accessed by recording audio on a computer using a microphone, CD-ROM or another input device. Audio plays a crucial role in the development of multimedia. There are a few kinds of sound that can be utilized in multimedia: sound effects, natural sound, instrumental notes and Human voices (Azliza, 2015).

2.3.2 Multimedia Learning

Many researchers have concurred that multimedia has numerous characteristics to encourage learning (Beeland, 2002; Hick, 1997; Acha & Mayer, 2009, Abdulrahaman et al., 2020). Multimedia offers a kind of effective learning environment by combining a variety of formats such as text, pictures, animations, audio, and videos (Doolittle, Bryant, & Chittum, 2015, Abdulrahaman et al., 2020). Multimedia learning includes learning by text and images, textbooks and illustrations, computer lessons with animations and stories, slide shows with graphics and presentations with sounds (Mayer, 2009). It has been shown that interactive multimedia saves time, engages, and motivates learners throughout the learning process (Hick, 1997). Beeland (2002) mentions that the capability of interactive multimedia to catch and retain the concern and concentration of students can encourage and develop cognitive engagement.

2.3.2.1 Multimedia Learning Definition

Mayer (2009) stated that multimedia learning indicates the learning of images and words. The learning process uses multimedia presentations and teaching methods, commonly in a similarly structured environment or a classroom. In general, it can be

used in any topic, mainly any form of the learning process that can be accomplished or increased by the appropriate application of multimedia material (Wisegeek, 2010).

2.3.2.2 Goals of Multimedia Learning

Mayer (2009) points out that multimedia learning has two aims: recalling and understanding. Recalling refers to the ability to perceive or replicate the content offered and can be measured by retention tests. On the other hand, understanding can occur when students construct a coherent mental representation from the displayed materials.

2.3.3 Advantages of the Use of Multimedia in Education

The education system, particularly teaching and learning, has been altered by the rapid growth of interactive multimedia technologies (Wang, 2016). The information delivery process becomes more efficient using various media types like text, images, animation and video. Incorporating multimedia into the learning process can improve it since it provides users control over data delivery and supports intelligence (Mayer, 2014). Multimedia can bolster numerous portrayals of similar data in various arrangements, giving understudies an actual learning condition by providing different roles and points of view (Cairncross & Mannon, 2001).

Multimedia components can be integrated into learning materials for all education levels. Mannon and Cairncross (2001) mention that multimedia can present information in Multiple formats, facilitates interaction and allows individuals to monitor how they want to collect information. In education, multimedia nowadays has

been accepted as a teaching aid by teachers. According to Schroeder (2010), incorporating computer technology multimedia into learning instructions will enable teachers to capture students' attention and engagement, describe complicated concepts, enhance productivity, and have fun.

Students' cognitive abilities are improved by combining digital and physical parameters through animations with augmented reality, which stimulates learners' interest and enhances the learning experience. Gaming has been demonstrated to promote medical education by enhancing dental students' academic writing skills and nursing and pharmacy students' empathy. These studies show that using multimedia as a form of blended learning appeals to different learning styles and is better than traditional lecture delivery (Vagg, Bolger, Balta, & Lone, 2020). The use of multimedia-based instructional aid as part of a teaching plan has many potential benefits related to the learner, the learning content, the instructor, the learning process, and access to learning.

2.3.4 Multimedia in Teaching and Learning Vocabulary

Few studies have been conducted on improving students' vocabulary using multimedia, as shown in Table 1. The research investigated the impact of multimedia in teaching vocabulary; all the studies showed that multimedia could benefit students learning English vocabulary.

Table 2.1

Existing Apps for Vocabulary Learning

Author / Year	Title	Finding
Marina Dodigovic (2013)	Vocabulary Learning with Electronic Flashcards: Teacher Design vs. Student Design	The findings suggested that students learn most effectively using their preferred tactics or teacher-designed cards. On the other hand, students who designed cards used semi-contextualizing information less skillfully than designed cards of their teachers. As a result, semi-contextualizing digital flashcards created by teachers may benefit students more.
Hsiu-Ting Hung (2015)	Intentional Vocabulary Learning Using Digital Flashcards	The aggregate research findings underline the usefulness of learning vocabulary with digital flashcards as an alternative to more conventional resources and bring attention to the relative importance of integrating digital flashcards in collaborative learning activities in classroom settings.
Bor Tyng Wang (2017)	Designing Mobile Apps for English Vocabulary Learning	The findings indicate that the proposed English vocabulary apps increase students' motivation for language learning, cultivate students' self-learning habits, provide a ubiquitous learning environment, build students' confidence in language learning, and adhere to the

Cognitive Theory of Multimedia
Learning (CTML).

Ruo Wei Chen and Kan Kan Chan (2019)	Using Augmented Reality Flashcards to Learn Vocabulary in Early Childhood Education	Results showed that both AR and regular flashcards had a significant impact on children's vocabulary learning, and there was no significant difference in their effectiveness.
Kara Sage, Michael Piazzini, John Charles Downey, and Sydney Ewing (2020)	Flip It or Click It: Equivalent Learning of Vocabulary from Paper, Laptop, and Smartphone Flashcards	There was no significant difference in students' learning ability across platforms, except for those who spent more time studying paper flashcards.

Dodigovic (2013) carried out a study to find the most beneficial digital flashcard activities created by teachers or students themselves. WordCamp, an online platform, was used to facilitate the creative process. Participants were exposed to two card-based treatment terms (teacher-designed and self-designed semi-contextualizing electronic word cards). The findings suggested that students learn most effectively using their preferred tactics or teacher-designed cards. On the other hand, students who designed cards used semi-contextualizing information less skilfully than designed cards of their teachers. As a result, semi contextualizing digital flashcards created by teachers may benefit students more.

Hung (2015) did another study to see whether and how digital flashcards may be used in a university course to aid language learners learning English vocabulary. This study aims to present a clear image of using digital flashcards to help learners' vocabulary acquisition in EFL settings. A classroom experiment examined how incorporating digital flashcards into purposeful learning tasks can improve students' vocab learning outcomes and experience. The aggregate research findings underline the usefulness of learning vocabulary with digital flashcards as an alternative to more conventional resources and bring attention to the relative importance of integrating digital flashcards in collaborative learning activities in classroom settings.

One study was done on designing mobile apps for vocabulary learning in English by Wang (2017). This study aimed to ascertain students' attitudes toward the created app and the potential value of self-learning. The study's goal was to help college students acquire English vocabulary more effectively by providing English and Chinese examples. This study included 30 students at the CEF A2 level (low level). The pilot study's primary content was the New General Service List (NGSL). Twenty-four vocabulary learning modules were created for students throughout the academic year. Each week, students were expected to memorize thirty new words. Students' attitudes toward the apps were elicited using a questionnaire. The findings indicate that the proposed English vocabulary apps increase students' motivation for language learning, cultivate students' self-learning habits, provide a ubiquitous learning environment, build students' confidence in language learning, and adhere to the Cognitive Theory of Multimedia Learning (CTML).

Another study on Using Augmented Reality Flashcards to Learn Vocabulary in Early Childhood Education was conducted by Ruo Wei and Kan Chan (2019). By contrasting digital flashcards with traditional paper flashcards, this study seeks to determine the technology's value in early childhood education. To that purpose, 98 children and four teachers, all from a Macau kindergarten, participated in a research study. AR flashcards were used by one group of students to learn animal vocabulary, while another used standard flashcards. A pre-and post-test on children's vocabulary was used to evaluate the effectiveness of the two approaches. Teachers were also questioned. Results showed that both AR and regular flashcards had a significant impact on children's vocabulary learning, and there was no significant difference in their effectiveness.

Flip It or Click It: Equivalent Learning of Vocabulary from Paper, Laptop, and Smartphone Flashcards by Sage, K. et al. 2020. Compared college students' learning of vocabulary on paper, laptop, and smartphone. Students were assigned randomly to one platform for reviewing vocabulary flashcards and then took a memory test and responded to questions about their perceptions of these technologies. Results showed equivalency in students' learning across platforms, with the only exception being that students spent longer reviewing paper flashcards.

It makes a lot of sense to use multimedia to help teach and learn foreign languages; it creates an interactive learning environment for the student. Carpenter and Olson (2012) state that pictures have been demonstrated to be more effective and easier to remember than just words when used to teach vocabulary in a foreign language

2.4 Cognitive Theory of Multimedia Learning (CTML)

Mayer's Cognitive Theory of Multimedia Learning (CTML) (2001) explains how humans acquire knowledge through two simple channels: verbal and visual. Mayer's theory is based on meaningful learning and takes inspiration from the research of Wittrock et al. on generative theory and Paivio et al. on Dual Coding Theory (Mayer, 1996). According to the generative theory, Meaningful learners engage when they select relevant information from what is provided, organize it into a coherent mental image, and integrate newly built presentations with others (Mayer, 1996). It describes the cognitive processes within two different information processing systems: the visual processing system for visual learning and the verbal processing system for oral learning (Mayer, 1996). Figure 2.1 Mayer shows how multimedia presentation gets through the eyes and ears in sensory memory.

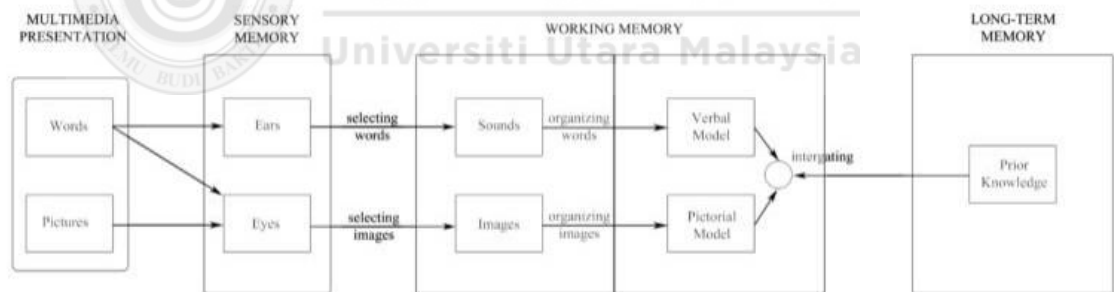


Figure 2.1. Cognitive Theory of Multimedia Learning (CTML) (Source: Mayer, 2001)

In Mayer's Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2009), as depicted in Figure 2.1, there are three key assumptions about meaningful cognitive processes: dual coding, limited capacity, and active processing. In the dual coding assumption, humans have two separate and interconnected channels for processing information: visual/pictorial and auditory/verbal. In the limited capacity assumption,

learners have limited cognitive resources available for processing information in the visual and auditory channels. In the active processing assumption, learners actively engage with the material by selecting relevant visual and verbal information, organizing it into a coherent mental structure, and integrating it with their prior knowledge.

The role of Mayer's CTML is as guidance to the creation of quality multimedia teaching materials for students that fully utilize how the brain processes visual and auditory information. Teachers and instructional designers are encouraged to apply multimedia learning principles that utilize brain cognitive abilities with visual and auditory capabilities provided by texts, images, graphics, animations, videos, and narratives in designing multimedia materials for teaching and learning (Azliza, 2015). The empirical research proposed some prescriptive principles to aid multimedia designers in producing educational materials more suited to human cognitive architecture that can eliminate or reduce mental burdens, confusing variables, and information incompetence (Mohamed, 2012; Rapp, 2013).

The theoretical justification for this principle is that learners would have a high interest and understanding in English vocabulary when the application provides a suitable picture that relates to or describes the meaning of that word. Our eyes' ability to perceive and interpret movement is often underrated, especially regarding moving visuals. Thus, multimedia creates a better mental picture.

2.5 Multimedia Design Principle

Mayer introduces the principles of multimedia learning (2001); these principles lead the development of attractive multimedia courseware without the traditional face-to-face technique. It is mainly focused on the design and organisation of courseware. Twelve research-based principles (Appendix G) for building multimedia applications have been proposed by Mayer (2009) as the Multimedia Design Principles. The principles apply to any mix of texts and images in the design, rather than simply text, and explain how multimedia components help people learn more effectively. It is also proposed that each of the principles be applied in the context of the CTML. Several previous research applied multimedia learning principles described by Mayer (2014) in different multimedia learning contexts to determine which findings can result in a better learning process.

The multimedia principle (Mayer, 2001) refers to the robust research finding that the learning process with pictures and words is more efficient than learning using words alone. However, the term multimedia principle refers more generally to learning assisted by different visual and verbal content types when delivered in combination. As advances in technology and computational power have increased, more varied forms of visual content are becoming standard components of multimedia instruction. Visual content may be provided in illustrations, graphics, charts, photographs, diagrams, animations, simulations, videos or other visual representations (e.g., three-dimensional models). The justification for this principle is that learners would have a high interest and understanding in English vocabulary when the application provides a suitable picture that relates to or describes the meaning of that word.

Table 2.2 Summarizes the multimedia principles employed by researchers. Most of the articles discussed the use of multimedia concepts in education and learning. It demonstrates how all the intended outcomes of multimedia may be used to encourage and assist learners.

Table 2.2

The Use of Multimedia Design Principle in Education and Learning

Author / Year	Title	Multimedia principle	Finding
Nurtihah, Mohamed Noor (2012)	Al-Adab: Islamic Sex Education Courseware Using Cognitive Theory	1. Spatial Contiguity Principle 2. Temporal Contiguity Principle 3. Coherence Principle 4. Modality Principles 5. Redundancy Principle 6. Multimedia Principle	As measured before and after using the ISE courseware prototype significantly boosted the parents' knowledge. The ISE prototype's reaction evaluation indicated that it could encourage ISE learning.
Azliza Bt Othman (2015)	The Effects of Conversational Versus Formal Narrative Styles Of Persuasive Multimedia On Children's Knowledge, Awareness And Motivation Of Child Sexual Abuse	1. Personalization principle	Results show that after using PMLA, children's knowledge, awareness, and motivation increased.
Adam Pate, PharmD, BCPS, Savannah Posey,	Effects of applying multimedia design principles in PowerPoint lecture redesign	1. Coherence principle 2. Signalling Principle 3. Spatial Contiguity Principle 4. Modality Principle	Using a multimedia design approach can help students remember and retain more of the information provided

PharmD, BCPS (2016)		5. Redundancy Principle	to them. There was a favourable response from students, which suggests that they may prefer this approach over the more standard PowerPoint slide
Al-Rikabi, Mohammed d Abbas Neamah (2016)	Design Guidelines for Arabic Mobile Learning Application Based on Cognitive Theory Of Multimedia Learning	1. Coherence Principle 2. Multimedia Principle 3. Spatial contiguity Principle 4. Temporal contiguity Principle 5. Voice Principle	The A4Kids user evaluations show that it is straightforward to learn, simple to use, and valuable for kids. It can also help them learn Arabic quickly, directly, and effectively, no matter where or when.
Mohamad Lutfi Dohalit, Sobihatun Nur Abdul Salam, Ariffin Abdul Mutalib, Muhamad Saiful Bahri Yusoff, Farah Nadia Azman (2018)	Persuasive Multimedia in Truancy Awareness (PMTA): Integration of Persuasive Design Principles	1. Multimedia Principle	The PMTA multimedia application focuses on using multimedia content and persuasive tactics to raise awareness.

In brief, the principles of multimedia design instruct the use of any combination of texts and images rather than just the use of text alone in creating the DFA. The

multimedia principle has been considered for improving international students' English language vocabulary mastery. Since the DFA was designed for international students aged 19 to 24 years old, the picture has been chosen to represent the word's meaning and give the student a clear understanding of that word. The use of the image is appropriately designed to support the multimedia principle.

2.6 Persuasive Technology

Fogg (2003) describes persuasive technology as applications that are part of a persuasive technique and include interactive aspects to alter a person's attitudes and actions. The integration of persuasion components and computers guides to 'Computer as Persuasive Technology', known as Captology. The applications of Captology are mainly on interactive design, research, and activities of interactive computing products. Fogg defined Captology as a functional triangle, a conceptual framework that explains the various functions that computing technology can perform.

The Functional Triad demonstrates how people react to computer technology in three distinct ways: computers as persuasive tools, computers as persuasive media, and computers as persuasive social actors. First, computers as persuasive tools can convince people by making particular actions more straightforward or more effective or by directing people through a calculation or measurement that encourages them to do so. Second, the computer is a persuasive instrument that may convince people by encouraging them to analyze cause and effect relationships and offering them perceptions that encourage or enable them to practice behaviour. Last, as a social actor,

the computer can convince individuals by praising them with positive responses, modelling a desired action or attitude, or offering social support.

The application of persuasive technology will improve the future of marketing, sales, and everyday behaviour. Currently, the persuasive technology method has been employed by several researchers in the design and development of apps intended to influence human behaviour in a predetermined way.

Briefly, persuasive technology is a tool that combines computers with persuasion. Interactive computer systems that attempt to influence people's attitudes and behaviours are persuasive technology (Fogg, 2003). This study defines persuasive technology as developing an interactive application to increase student's satisfaction. The persuasive features of interactive applications will be discussed in the following subsection.

2.6.1 Captology

Fogg (2003) defines Captology as the process by which persuasive computers are programmed to alter people's attitudes or behaviours. Fogg describes Captology as the design, research, and analysis of interactive computer products to improve people's attitudes or behaviour. This recent study investigates the related roles of persuasion (raising awareness, influencing, motivating, and changing behaviour, for example) and digital technology (Figure 2.2).

Captology was initially developed to study the consequences of changes in people's attitudes or behaviours; it was evident that many computer products are intended to

influence how people think and behave. The focus is on the benefits to people's health and road safety. Captology applications frequently persuade us to provide personal information that could be exploited in many ways.

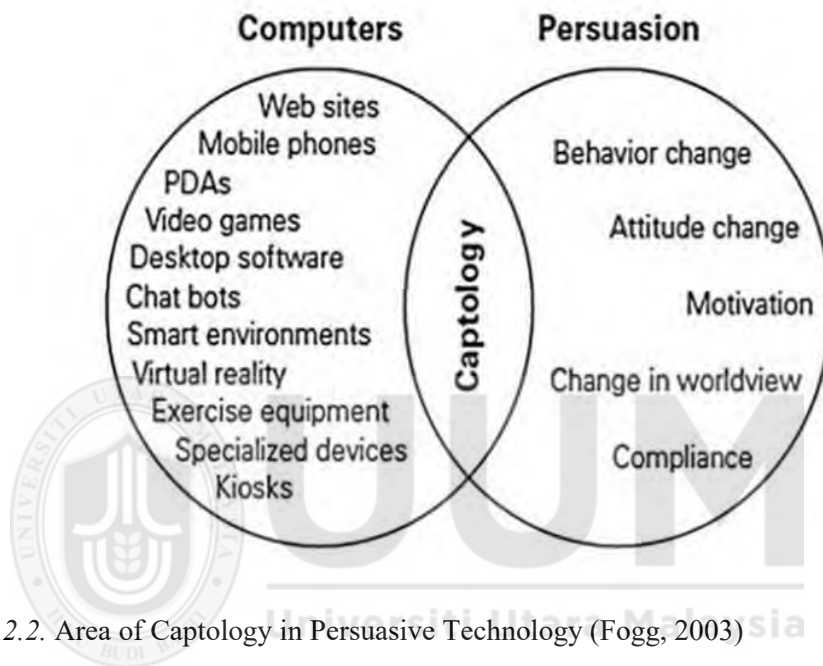


Figure 2.2. Area of Captology in Persuasive Technology (Fogg, 2003)

2.6.2 Persuasive Design Principles

Persuasive design is a relatively new model of planning information activities that only respond to attitudes and behaviour (Lockton, Harrison & Stanton, 2010). This study's design strategies would use both micro and macro techniques in the design process. The macro strategy in this study includes the principles of persuasion of Fogg (2003), such as similarity in the design and development of DFA.

2.6.2.1 Similarity Principle

In psychology indices, the principle of similarity is one of the essential principles of persuasion; those who share our interests, personality traits, or other qualities are more likely to inspire and reassure us than people who are not identical. This is what Fogg's Principle of Similarity assumes in technology. Therefore, when designing a product, a designer may increase the appeal of their technology or product by focusing on a target audience.

Several studies have been done on how computers persuade people in attitude and behaviour change to comprehend how to apply the persuasive technique in learning; researchers must identify the components, elements, and theories and methodologies used in their experiments. Additionally, this study will analyze persuasive multimedia techniques throughout the last five years (2010-2014). This group of related works was chosen based on the persuasive technique applied.

Table 2.3

The Implementation of the Persuasive Technique in Education and Learning

Author / Year	Title	Persuasive Technique
Sobihatun, Wan Ahmad Jaafar, Azilah (2010)	Children Dental Anxiety	1. Praise 2. Similarity 3. Social learning 4. Virtual Rehearsal
Arifah Fasha, Nadia (2011)	I-IQRA	1. Contiguity 2. Information Quality 3. Praise 4. Self-Monitoring 5. Similarity

Wan Ahmad Jaafar, Siti Nor Jannah, Mohamed Zamri (2012)	Persuasive Multimedia Stress Awareness	1. Cause and effects 2. Similarity 3. Social learning
Azliza, Wan Ahmad Jaafar (2013)	Child Sexual Abuse Awareness	1. Cause and effects 2. Similarity 3. Simulation 4. Virtual Rehearsal
Wan Ahmad Jaafar, Mohamed Zamri (2014)	Abused Disabled Parking	1. Praise 2. Similarity 3. Social learning 4. Virtual Rehearsal

From the above discussion, Table 2.3 Summarizes of persuasive technique employed by researchers. Most of the articles discussed the implementation of the persuasive technique in education and learning. It demonstrates how all the intended outcomes of persuasive technology may increase users' awareness and encouragement.

According to the reviewing papers on multimedia as an attitude changer, some design considerations should be addressed while creating successful persuasive multimedia. Thus, this study will investigate the evolution of attitudes using persuasive multimedia as the first move in technology, particularly in the educational domain. However, persuasive technology, strategy, and concept must be determined to be appropriate for the student's attitude.

It can be inferred that attitudes and behaviours can be changed with the use of the computer as a persuasive tool. A persuasive multimedia technology that actively persuades learners learning is more exciting and engaging and makes it easier to

connect and inspire students to complete the task and acquire a level of objectivity. As a result, it will help many students by enhancing their behavior, psychology, and academic performance.

The users must easily recognize a product to persuade more users to alter their behaviour or attitudes. Therefore, in designing the digital flashcard English vocabulary application, the similarity principle is applied using similar content and learning situations. In addition, the metaphors in DFA are ensured by mapping learners' familiar environments such as books and flashcards.

2.7 Digital Flashcard

Flashcard is a card that holds information on one side and an image on the other side, used in classroom practice or private sections. Flashcard is a card made up of a single image, word or phrase. It can be classified according to the type of cards, such as the transports, the places, the tools, and the people's characteristics (Baleghizadeh & Ashoori, 2011). Flashcards are a group or set of cards that include data. Sometimes language teachers utilize flashcards to teach new words to students. Flashcards sometimes have words or definitions on one side while the pictures are on the other. Flashcards are beautiful tools for teaching English when teachers introduce new vocabulary to students and practice the exercise (Chien, 2015).

However, digital flashcards are designed and developed to replicate the traditional one. Users can perform similar tasks with digital flashcards, such as making individual cards with images and text; practising with cards, printing paper-based card versions; and exchanging the cards with other users (Green and Bailey, 2010). Additionally,

digital flashcards allow for a new perspective on traditional learning methods; In contrast, the traditional flashcard is a two-sided piece of paper with a question and an answer on one side. Digital flashcards expand on this by integrating multimedia, data processing, and spaced repeater systems that time repeat access to cards to optimize retention of information (Colbran et al., 2017).

2.7.1 The Advantages of Using Digital Flashcards

A digital flashcard is a teaching tool that may be used to assist in teaching and learning languages, particularly vocabulary. It is increasingly used in language classes as a teaching medium; it can contain a single word, phrase or image and be classified according to class (Aulia, 2016). Recent, with the rise of mobile applications and smartphones, Apps designed to encourage studying, like flashcard apps (Shelly, Gunter & Gunter, 2013). So, digital flashcards could be good to use them. They have also noticed that:

"Compared to traditional flashcards, flashcards used on smartphones have the additional advantages of being available whenever the smartphone is in use, carrying as many cards as desired for multiple classes, and collaborating with other students to create large groups of flashcards. Also, smartphone technology enables the students to set reminders to study".

Isabella (2014) writes about the history and effect of flashcards that act as a memory tool that helps learners memorise information. Additionally, she states that creating and studying flashcards with friends or a group may be more productive, and students can share knowledge, quiz one other, develop social groups, and improve their literacy

skills. Visual flashcards with images may be an enjoyable way to study for students. Voxy, a developer of mobile applications, including flashcard applications, performed an anonymous investigation on the usefulness of flashcards for language learning in 2011; according to the survey results, 93% of respondents felt that flashcards assist students in learning languages.

2.8 Summary

Based on the literature, multimedia and multimedia as a tool for facilitating learning has been discussed in the knowledge of vocabulary lack of acquisition. Additionally, this chapter discusses the components of persuasive technology, theories, and principles that comprise the DFA's theoretical framework for instructional design.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter discusses the design and development of the DFA. The Alessi and Trollip Instructional Design (ATID) model was used as a design and development model that combines three primary phases: planning, design, and development. This study investigates the impact of DFA on improving foreign university students' English vocabulary mastery and perceived satisfaction. Thus, this chapter also discusses the research methodology used in this study, which discuss the research design, population, sample, learning materials, research instruments and research procedures.

3.2 Alessi and Trollip Model for Design and Development

Developing software needs a set of systematic and practical procedures. Therefore, a particular software development model should guide the design and development process. This study will use the ATID model suggested by Alessi and Trollip (2001) for designing and developing the DFA, as explained in (Figure 3.1).

The model consists of three phases, and the three phases are planning, design, and development. In this study, some parts of the activities are not performed in DFA development. The following section will discuss each activity in every phase.

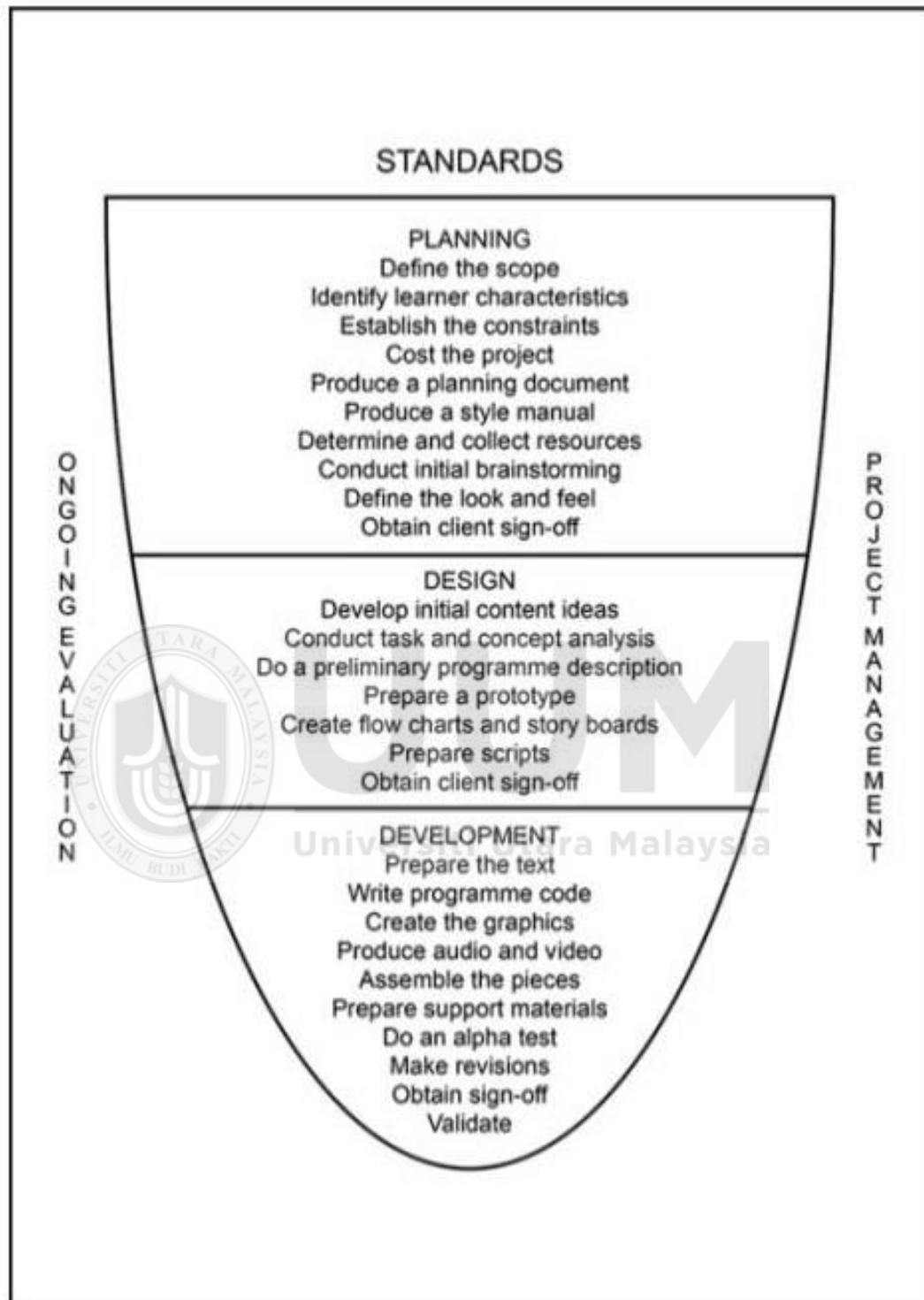


Figure 3.1. ATID Model for Design and Development (Source: Alessi & Trollip, 2001)

The ATID model was applied in the design and development of the DFA because of its adaptability and flexibility. Adopting the ATID model is a decision made particularly for multimedia development as the model includes the inclusive planning, design and development of the multimedia software development phases (Alessi & Trollip, 2001). The ATID model could be used in most fields because of its adaptable features and flexibility that meet individual needs. The developed system can be modified or improved since it allows the continuous evaluation of the prototype.

Another rationale for selecting the ATID model was its emphasis on creativity. According to Alessi & Trollip (2001), inefficient multimedia instruction programs are also generated due to an overly formal and static instructional design process that prevents instructional materials creators from being inventive, without imagination, the produced training material is unlikely to be entertaining and may not benefit the process of teaching and learning.

3.2.1 The Planning Phase

The planning phase includes a deep understanding of DFA and evaluates all the restrictions (Alessi & Trollip, 2001). For DFA, the planning phase consists of four steps. Figure 3.2 shows the planning phase starts with determining the scope of DFA content. Then went on to identify the learner's characteristics, establish restrictions, and determine and collect resources.

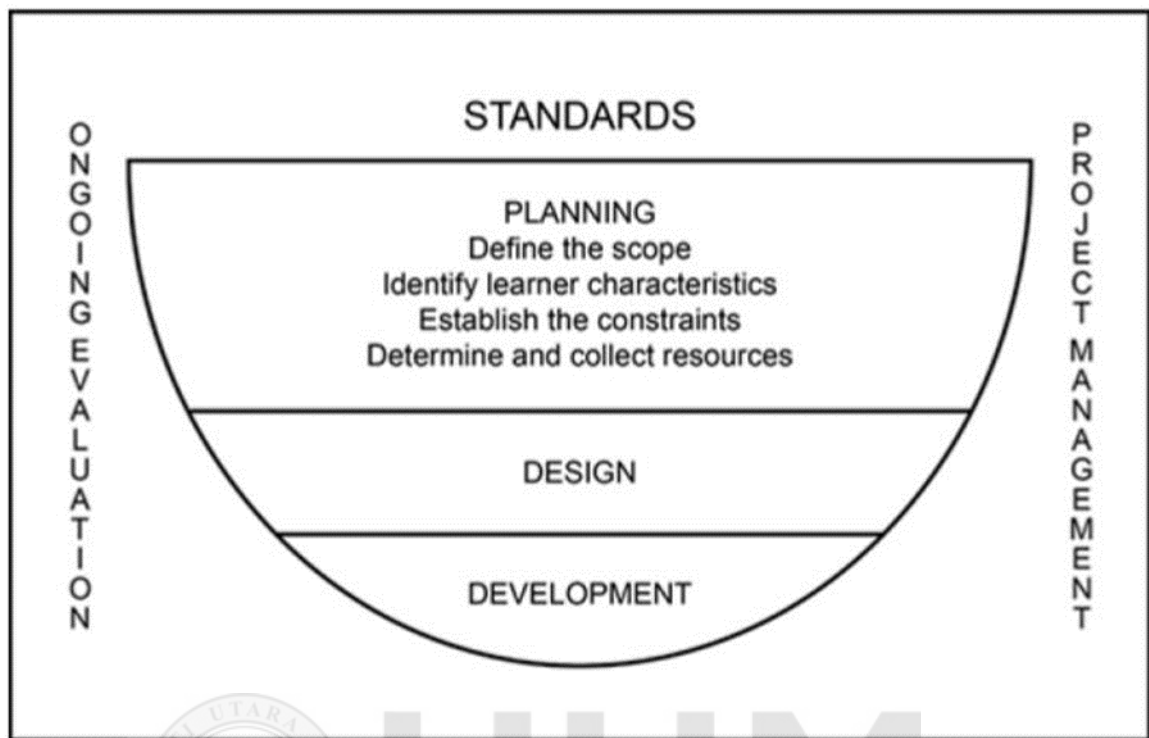


Figure 3.2. The Planning Phase (Source: Alessi & Trollip, 2001)

i. Defining the scope

The planning process would have to include ensuring the material's reach, the intended learning outcome, and the student's level of proficiency (Alessi & Trollip, 2001). In the current investigation, the DFA that is developed intended to improves students' vocabulary mastery and perceived satisfaction.

All available content and resources have been analyzed and modified based on the Intensive English Program (IEP) to guarantee that the DFA's required content based on the respective coursebook which is (Pathways 2: Listening, Speaking and Critical Thinking.

ii. Identify Learner Characteristics

In this study, the critical learner characteristic are student education level and student motivation in learning English as foreign language. This is important to ensure that the DFA is appropriately intended for students and the content coordinates the student level. The samples for this study were IEP students.

iii. Establish the Constraints

The design and development of the DFA must have clear limitations; therefore, this study identifies all factors that impact the DFA's development, operation, and delivery. Even though the main limitations that will appear during the research are the level to which this technique will improve student vocabulary mastery and perceived satisfaction.

Another aspect that this study that needs to be explained before developing the DFA is the fundamental requirements for the development, such as hardware, software and multimedia assets. A modern and advanced hardware are required to run the application.

iv. Determine and Collect Resources

Another planning stage component is gathering all the resources needed to design and develop the DFA. Shortly, three sorts of resources are required: subject-matter resources, instructional design resources, and delivery system resources.

As a first step, subject matter resources included any asset that can provide essential information and reveal how experts have structured the content. For the development

of the DFA, the study consulted with experts in the field to determine the suitable content. Since the DFA teaches vocabulary mastery, subject matter experts in the field are appropriate: namely an Intensive English Program lecturer with extensive experience teaching EFL was recruited for this study.

Second, instructional development resources involved text and an instructional design manual; this information is particularly essential to the production and organizing of ideas and the processing of individual displays. As a result, Alessi and Trollip's (2001) Instructional Design Model was the fundamental guide for instructional design.

Thirdly, delivery system resources include operating instructions and references, development software, user manuals and textbooks for development software, and a list of available individuals who have experience with the same computer and software. Adobe Photoshop CS6, Adobe Illustrator CS6, and Zapworks Studio were used to develop the DFA. Adobe Photoshop CS6 and Adobe Illustrator specifically used for graphic editing for appropriate vocabulary (Table 3.1).

3.2.2 The Design Phase

The design phase manages the tasks of gathering the substance. This phase guaranteed the proposed instructional item to be transformed into a reality. Essentially, four stages are adjusted: develop the content ideas, prepare the storyboards, and prepare a prototype, as shown in (Figure 3.3).

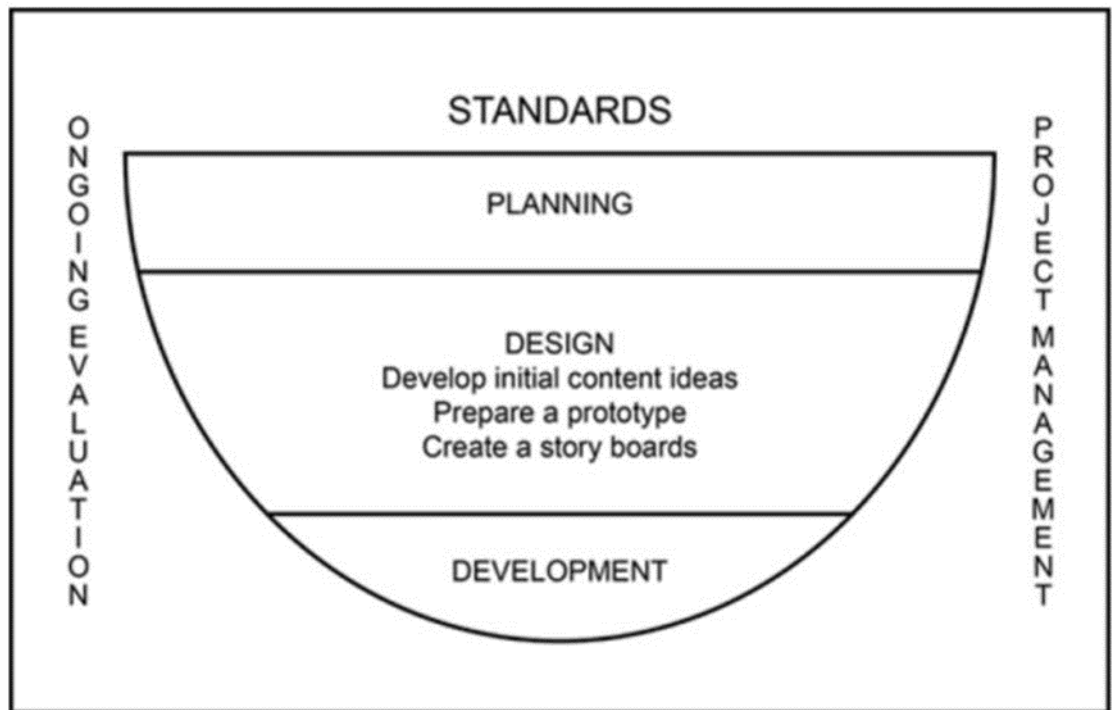


Figure 3.3. The Design Phase (Source: Alessi & Trollip, 2001)

i. Develop initial content ideas

The design phase starts with the generation of ideas for the content. One procedure that Alessi and Trollip (2001) was recommended to develop initial concepts for content is looking for ideas about content and learning method. For this study, looking for ideas about content and learning method was done by referring to the current Intensive English Program (IEP) coursebook (Pathways 2: Listening, Speaking and Critical Thinking).

ii. Preparing Storyboards

A storyboard is an excellent method for conveying the design, components, navigation, and interaction in the DFA. DFA storyboard in Appendix C has been

checked out by the subject matter that concentrates on the content, details and hardware and software suitability.

Storyboards are a sequence of drawings that depict the flow of educational materials and a review of their contents; they serve as a visual depiction of the project's design and details. Throughout this study, the storyboard comprises simple graphic representations of the finished product to be developed; the storyboard fits into the low-fidelity version of the DFA, which has evolved into a guideline for researchers for interaction and navigation explanations, audio content, and display features on each DFA screen. This helps researcher identify the requirements of the DFA within the accessible resources and time, arrange and decide which tool to use for each part of the DFA.

Scripts are primarily the text intended to design the prototype that includes speech (word sound). For DFA, two types of text will be prepared; one is a primary text is a script that shows important instruction material, which includes pronunciation of every single word and definitions. At the same time, the secondary text displays other information that consists of the textbook unit in DFA.

iii. Preparing a Prototype

The prototype is a simplistic perception of how the prototype will look and function, the system and the similitude utilized (Alessi and troll, 2001). To conduct this research, a computer-generated medium-fidelity prototype was produced, and the DFA prototype design was created using Adobe Illustrator CS 6, Adobe Photoshop

CS 6, Microsoft PowerPoint software and Zapworks Studio. After all the screens of the storyboard are completed, at that point, the development stage starts.

3.2.3 The Development Phase

The last stage is the implementation of DFA that contains the whole PC requirement. There were three stages associated with developing DFA, as found in Figure 3.4: creating graphics, interface, and animations and assembling all the pieces.

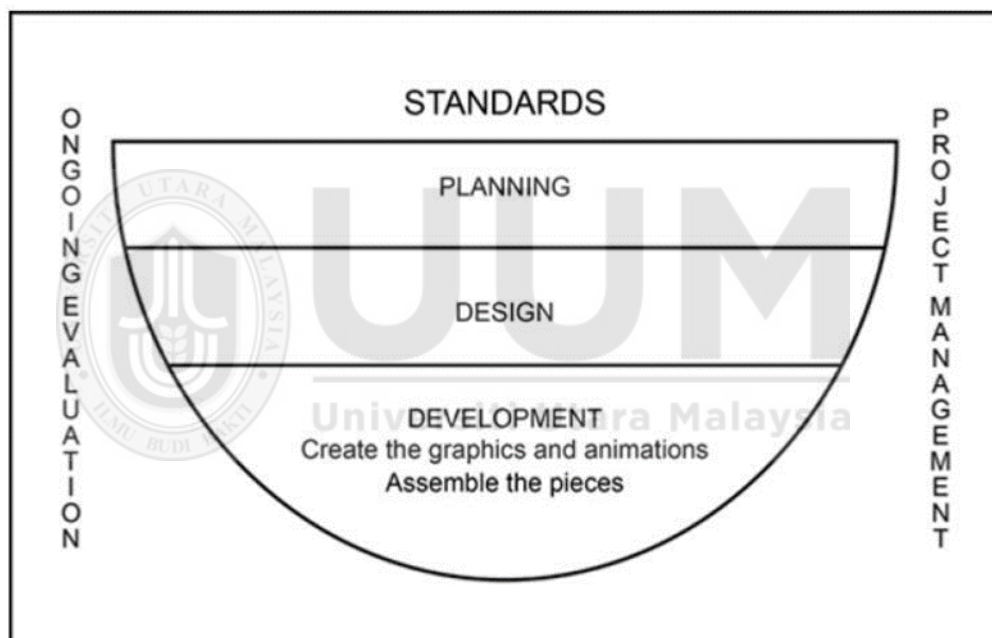


Figure 3.4. The Development Phase (Source: Alessi & Trollip, 2001)

i. Creating the Graphics, interface, and Animations

Three things are addressed when making graphics and animations. Firstly, the quality of the graphics has been ensured that it is appropriate for the context of the DFA. After this, ensure the quality of the graphics and drawing functions of the interface.

For multimedia sources constraints, this study has to produce some multimedia elements. Mainly, graphics, animations, and sound in DFA are produced independently utilizing particular software and are finally integrated using Zapworks Studio.

Researchers have finalized the font, icon, graphics, button, and sounds used. As said by Alessi and Trollip, all graphics produced and designed for teaching materials must have the same level of quality and design (Alessi & Trollip, 2001). The quality of the graphics must be compatible with the content and the intent of the instruction material. In this study, the graphics designed for DFA were two dimensional (2D) flashcards with a resolution of 300 dpi (dot per inch). These graphics were created by using Adobe Illustrator CS6 and Adobe Photoshop CS6. Additionally, card animation was also used in the DFA. This animation was created using Zapworks Studio. On-card text is written in a sans serif font since it is easy to read from both close and far distances (Nyumu, 2011).

Then the prototype was finally delivered as one application using Zapworks Studio. The application will be converted into a zapcode (QR code), so any mobile device that

supports this technology can scan and display it. Table 3.1 summaries all software used in the design and development of the DFA.

Table 3.1

Software Use in design and develop DFA

Software	Description
Zapworks Studio	authoring tool to create 2D & 3D animation. The Main platform for developing this project.
Adobe Photoshop CS6	Used to design the interface and edit pictures before import inside Zapworks Studio.
Adobe Illustrator CS6	Used to create graphics before import inside Zapworks Studio.
Format Factory	used to convert picture files.

ii. Assembling the Pieces

Since all elements have been made, such as interface, graphics, animation, and audio using different software, finally assembled, using Zapworks Studio.

3.3 Application of Theory and Principle as a Strategy in the Design of DFA

This section uses an experimental approach to combine macro and micro strategies as a theoretical basis for designing the DFA.

3.3.1 Macro Strategy: Persuasive Design Principles

In macro strategy, one persuasive design principle was used in emphasizing the importance of students' perceived satisfaction (Figure 3.5). This study recognizes the principle of similarity as the most potent persuasive tactic (Fogg, 2003). This study made the application more persuasive by designing it appropriately and similar to the course content of the IEP. The similarity principle was apply in DFA by ensuring the DFA content are tally to the syllabus of IFP course content. Figure 3.5 shows the main page of the DFA which similar to the IEP textbook.



Figure 3.5. Similarity Principle applied in the main page of DFA

Figure 3.6 shows the content of the DFA that applied similarity principle. This principle are suitable to encourage and improves students' perceived satisfaction in understanding English vocabulary.

MEANING FROM CONTEXT  Read the information about an experiment. Notice each word in blue and think about its meaning

DR. ALIA CRUM'S MILKSHAKE EXPERIMENT

Introduction:

We know that seeing a picture of food can make us hungry, but Dr. Crum, a psychologist and researcher, want to find out whether reading food labels can affect the body. Her conclusion was that our attitude is relevant to the way our bodies respond to food.

To understand this experiment, it is important to understand the hormone ghrelin. When you have not eaten, the level of ghrelin in your body rises. It **stimulates** feelings of **hunger** and "tells" us we need to eat. After we have eaten enough, the level drops, we feel full, and our bodies use the food for energy and **strength**.

Results:

Dr. Crum's research **strategy** was to give two groups of people the same milkshake but with two different **labels**. First, the team asked participants to read the label on milkshake. Then participants drank the milkshake and rated the taste. The final step was a blood test.

The first group of participants read the label for "Sensashake" and drank a milkshake they believed had 140 calories and 0 grams of fat. Blood tests afterwards showed very little change in their ghrelin levels.

The second group read the label for "Indulgence" and drank a milkshake they thought had 620 calories and 30 grams of fat. The label convinced participants that they should feel full, and in fact, their ghrelin levels dropped significantly, so they did feel full and satisfied. The only **element** of the experiment that was different between the two groups was the label on the milkshake.



Strawberry milkshakes

Discussion:

When food manufacturers **market** their products, they create labels to **appeal** to the taste and interests of consumers. When they **target** people who want to be healthy, for example, their food labels might include a picture of someone exercising outdoors. Crum's experiment suggests that our ideas about a food product - even before we eat or drink it - may affect us in unexpected ways.

Figure 3.6. Similarity Principle applied in DFA

3.3.2 Micro Strategy: Multimedia Design Principles

During the design and development of the DFA, the multimedia principle will be implemented in this study. The principle explained that users learn better from multimedia lessons by integrating text and images rather than just text. Since the idea of a flash card is based on the use of images and text or text only in some cases to deliver information, whether it is vocabulary, definitions, historical evidence, etc. The idea of the application is based on the same thing by using the digital card that contains the image and the text to convey the meaning and understand the English vocabulary as shown in the (Figure 3.7) and that is consistent with multimedia principle of (Mayer, 2009), which explained that users learn better from multimedia lessons by integrating text and images rather than just text.

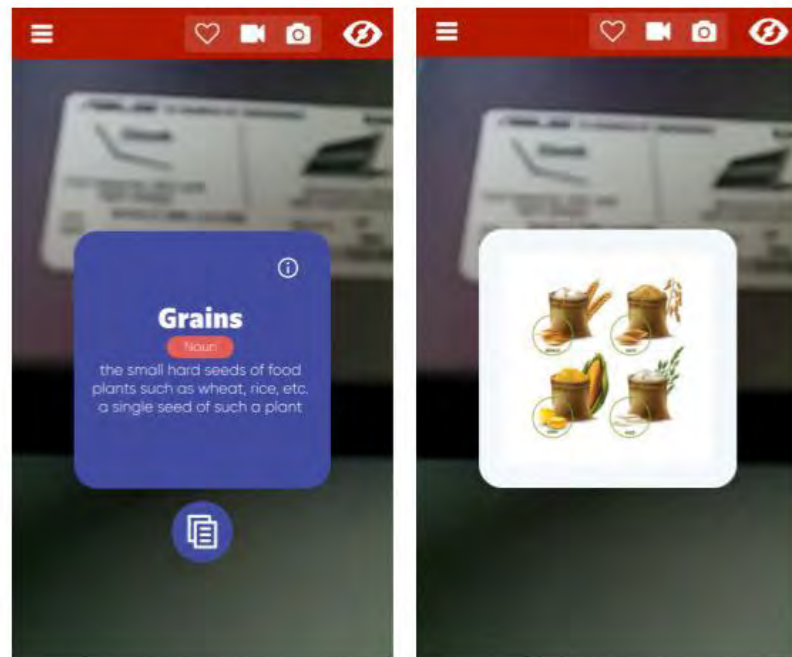


Figure 3.7. Multimedia Principle in DFA

3.4 Research Design

The objective of this study is to investigate the effect of the DFA on the English vocabulary mastery and perceived satisfaction of international university students before and after their usage of the DFA. This study utilizes a quasi-experimental approach (Randolph, 2008; Ary, Jacobs, Razavieh & Sorensen, 2006). This design helps this study examine the impact of the independent variable, the DFA, and the effects of the interplay between the variables (Gay, Mills & Airasian, 2006).

3.5 Research Variables

As seen in Figure 3.8, this study includes two types of variables; the research framework argues for one independent variable, the DFA, that attempts to influence the two dependent variables. Figure 3.7 explains the following:

1. The independent variable: The DFA, is predicted to demonstrate a significant difference in the dependent variables.
2. Dependent variables: consist of the performance scores after using DFA calculated by pretest and posttest of Vocabulary Test (VT) (attached in Appendix D), that measures student's vocabulary mastery and the scores of student's perceived satisfaction calculated by QUIS questionnaire attached in Appendix E.

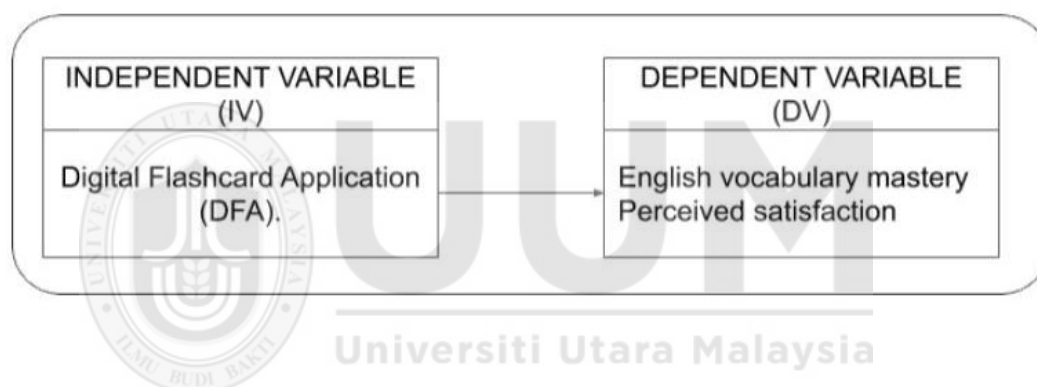


Figure 3.8. The Relationship across Variables

3.6 The Population and Sample

Purposive sampling is a non-probability sampling technique that is more effective when investigating a cultural field with experts; it may be used in qualitative and quantitative research. Bogdan and Biklen (1998) suggested that researchers frequently employ purposeful sampling to advance the theory by utilising unique participants. The method's intrinsic bias makes it effective, and even when evaluated against random probability sampling, the strategy remains resilient. Selecting a purposeful sample is critical to the quality of data collected; hence, the informant's dependability

and competency, purposeful sampling is a sample approach that will be employed in this study.

The study was carried at a public university in Malaysia, where students learned English as a foreign language sample size was 35 participants (N=35). Qasim et al. (2017) stated that 30 is the minimum sample size that may be used in statistical analysis. Students ranged from 19 to 24 years old, and these students have a foundation in the English language. They all participated in the requisite language course designed to improve students' knowledge of English in all four skills while also increasing their understanding of vocabulary. In this study, the students engaged in this treatment session via WebEx Meetings for (one hour and a half) per week.

3.7 Instructional Material

The DFA is designed and developed to improve students' English vocabulary mastery and perceived satisfaction. Accordingly, one of the principles of persuasive technology, similarity, is integrated into the DFA. Figure 3.5 and 3.6 show interface of the DFA that using cover design and content similar as student's textbook used in IEP class. Therefore, in designing the DFA, similarity principle is applied through the use of similar content and learning situation. In addition, the metaphors in the DFA are ensured mapping learner's familiar environment such as book and flashcard as shown in Figure 3.9.

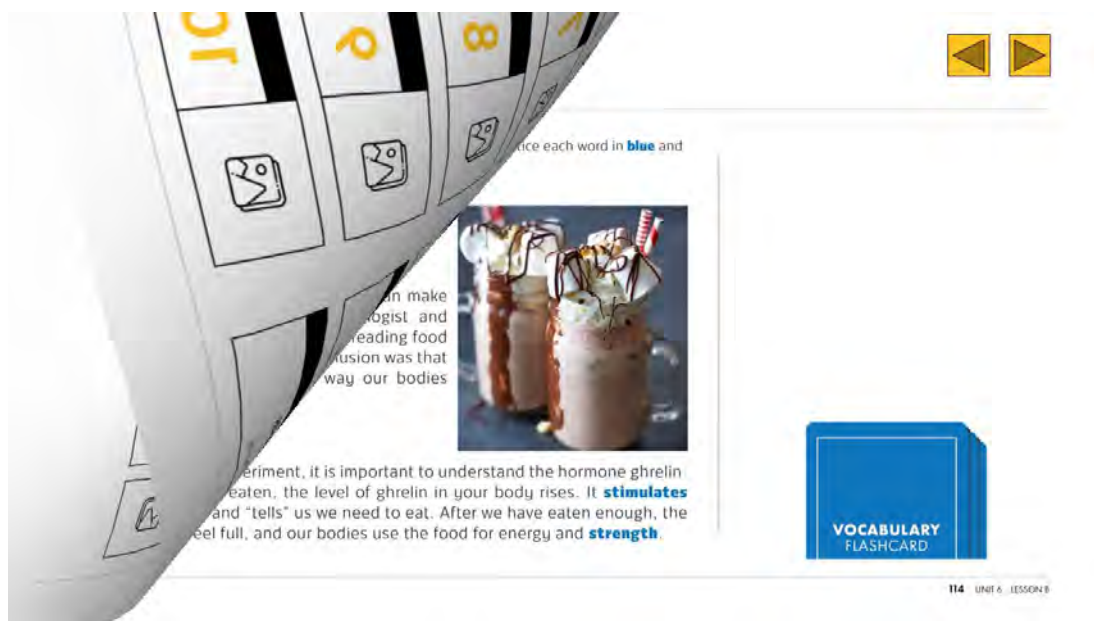


Figure 3.9. Book and flashcard environment in the DFA

The application cards are designed in accordance with the multimedia concept, one of Mayer's multimedia design principles (2009); the multimedia concept claims that individuals learn more effectively by including both text and visuals into the design. For increasing foreign student English language vocabulary, the multimedia principle has been considered. Since the DFA is designed for foreign student's age 19 to 24 years old, the picture has been chosen to represent the meaning of the word and give the student a clear understanding of that word. The use of the picture the flashcard is designed in a proper way to support the multimedia principle as shown in Figure 3.10. When the student want to learn more about any word learn in vocabulary section, they simply click on that words and the word's flashcard will be shown form the flashcard stack.



Figure 3.10. Text and picture in the DFA

3.8 Research Instruments

This study will utilise two instruments: a pretest and posttest to measure student's vocabulary mastery and a questionnaire to evaluate student perceptions of satisfaction (QUIS) after using the DFA.

3.8.1 Student's Vocabulary Mastery

This study uses a Vocabulary Test (VT) to measure students' vocabulary mastery; this tool was utilized in the pretest and post-test session. VT questions are adapt from the Intensive English Program (IEP) coursebook (Pathways 2: Listening, Speaking and Critical Thinking) and Oxford dictionary (Appendix D). The questionnaire on VT consists of 24 main questions, divided into two sections: demographic and multiple choices.

A pretest was conducted to get basic knowledge of the respondents. A pretest is organized before a learner uses or involves in a learning, training or technological intervention process, while a posttest is organized after they complete the processes (Chapman, 2009). The posttest showed how many target words had been learned due to treatment. The same questions are using for pretest and posttest. To minimize the threat of 'test-wise' effect, the questions in the pre-test and post-test were randomly rearranged. However, the content of the tests remains unchanged.

Because pre-test and post-test are included similar questions, it may lead testing effects to happen. In this kind of situation, Student's performance on the post-test may increase due to their experience with the pre-test. So, randomly rearranged the pre-and post-test questions to reduce the possibility of a 'test-wise' impact. Even though the test content remains unchanged, the post-test will be conducted a week later; hence, students will be less likely to recognize the pre-test questions. Data collection will take place over a short period, only two weeks, to reduce the risk of compromised internal validity due to maturation or history; this period will reduce the remembering effect of pre-test questions on post-test questions.

3.8.2 Questionnaire for User Interface Satisfaction (QUIS)

Questionnaire for User Interface Satisfaction (QUIS) will determine the perceived satisfaction level of the student's experience after they have utilized DFA. This questionnaire was adapted from (Chin 1988) (Appendix E).

QUIS consist of five dimension: overall user reactions (5 items), screen (3 items), terminology and system information (3 items), Learning (2 items), and Usability and user interface (1 item).

3.9 Research Procedures

The actual study has been carried out at WebEx Meetings. Before the treatment, the researcher briefed the students on the aim of the treatment session then introduced them to the DFA. Two treatments session has been conducted through online using WebEx Meetings, assisted by researcher. The first treatment session meeting duration will be 50 minutes, while the second meeting duration will be 80 minutes. Table 3.2 clarifies the schedule of the Procedures of the study.

Table 3.2

Demonstrates the Schedule of Study Procedures

Week / Minutes	Digital Flashcard Application (DFA)
Week 01 (50 Minutes)	01-The researcher explained aims of the treatment session to the students (30 min). 02-The student sat for Pre-test (20 min).
Week 02 (80 Minutes)	01- The researcher introduced DFA: clarified the interface and navigation to students (15 min). 02-The students experienced the DFA (30 min). 04-Students answered: a) Post-test (20 min). b) Questionnaire User Interface Satisfaction (QUIS) Survey (15 min).

3.10 Data Analysis

This study used the "Statistical Package for the Social Sciences" (SPSS version 26.0 for Windows) to analyze quantitative data. A paired sample t-test has been utilized during the examination to determine whether there is a significant difference in the mean in students' performance scores after using DFA.

The results have been specified whether there is a substantial improvement or not. In addition, The Pre-test- and Post-test vocabulary scores will be analyzed using the paired sample t-test, descriptive statistics with mean scores, standard deviation, and frequency values provided, including the overall development score in percentage will be calculated to determine how well the participants are on their vocabulary tests, respectively.

3.10.1 A Descriptive Statistic

A descriptive statistic refers to a statistical summary summarising a group of information (Mann, 1995). Also, Sekaran and Bougie (2010) define descriptive statistics as a method of showing data in an understandable format that easily enables the interpretation of a set of variables. Descriptive statistics, for instance, mean, standard deviation, minimum, maximum, and frequency, are extensively used in this study. These statistics provide statistical evidence to support the main hypothesis of this study: significant difference in a student's English vocabulary mastery after using (DFA).

3.10.2 Normality Test

This study will conduct a normality test after transforming the data depending on the content analysis approach and scoring system. This test's importance is to check whether this data is normally distributed or not due to many parametric tests such as correlation, regression, t-test, and ANOVA assume that the data have to be normally distributed. Different tests assess normality, one of which is skewness and kurtosis values. According to Rahman and Ali (2006), the data is normally distributed when the value of skewness is less than (± 1.96), and kurtosis does not exceed (± 2.00).

3.10.3 Reliability of VT and QUIS

Reliability refers to that credibility can be used to assess the accuracy and reliability of the test results. George and Mallery (2003) suggested that Cronbach's alpha be more significant than 0.7 to have sufficient and acceptable reliability.

3.11 Summary

The chapter describes the procedures used throughout the DFA's design and development; the prototype was designed and developed utilizing Alessi and Trollip's Instructional Design (ATID) Model. This section also elaborates on the research methodology used in the current study; quasi-experimental research measures the DFA's impact in enhancing students' vocabulary mastery and perceived satisfaction. The research methodologies, including the research design, population and sample, variables, instructional materials, research instruments, research procedures, and data analysis approach, are also addressed. This study aims to enhance students' performance and perceived satisfaction with vocabulary mastery using DFA.

CHAPTER FOUR

FINDINGS

4.1 Introduction

This chapter will discuss the findings from this study's assessment section, which aims to determine the impact of the DFA on foreign university students' English vocabulary mastery and perceived satisfaction. While the DFA is an independent variable, the dependent variables are student performance and perceived satisfaction.

The descriptive research was conducted using the Statistical Package for the Social Sciences (SPSS) version 26.0 for Windows; after running tests, the effects of DFA on student performance and perceived satisfaction were calculated, and this chapter elaborates on the descriptive statistical analysis. The findings summary is used to respond to the research questions in Chapter 1.

4.2 Demographic Information

The following table summarizes the participants' demographic information who answered the questionnaires:

Table 4.1

Gender of Participants

Gender	Frequency	Percentage %
Male	23	66
Female	12	34
Total	35	100

According to Table 4.1, most responders are male, with 23 (66 %) students, followed by females, with 12 (34%) students.

Table 4.2

Nationality of Participants

Nationality	Frequency	Percentage %
Yemen	20	57.14
Saudi Arabia	3	8.57
Thailand	2	5.71
Indonesia	9	25.71
Somalia	1	2.86

Table 4.2 shows the nationality of participants 20 (57.14%) are from Yemen, 3 (8.57%) are from Saudi Arabia, 2 (5.71%) are from Thailand, 9 (25.71%) are from Indonesia, and 1 (2.85%) is from Somalia.

4.3 The Reliability of Pre-test and Posttest

The reliability of the instrument is determined through a reliability study. After collecting data and conducting the test, the Cronbach Alpha for pre-test was 0.769, and the Cronbach Alpha for post-test was 0.734, as shown in Tables 4.3 and 4.4. Values indicate that the instrument is reliable based on George and Mallery's thumb rule (2003).

Table 4.3

Pre-test and Posttest Reliability Measurement

Element	Cronbach Alpha Coefficient
Pre-test	.769
Post-test	.743

4.4 Descriptive Analysis

A descriptive statistic refers to a statistical summary summarising a group of information, for instance, mean, standard deviation, minimum, maximum, and frequency, are extensively used in this study. These statistics provide statistical evidence to support the main hypothesis of this study: significant difference in a student's English vocabulary mastery after using DFA.

Table 4.4

Mean Score of Pre-tests and post-test

The Test	N	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Pre-test	35	4	20	12.91	3.921	-0.162	-0.194
Post test	35	10	20	17.74	2.582	-1.394	1.790

Table 4.4 show the mean score of pre-tests and posttest. The total pre-test score was 453 and the total posttest score was 621. The mean score received from the pre-test is 12.91 while the post-test mean score is 17.74. The results of posttest are affected by

new knowledge of targeted vocabulary that students have acquired using DFA. This indicates an increase (M difference) of (4.83) between pretest and posttest.

Table 4.5

Pre-test and Posttest Frequency Statistics

Score	4	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Frequency Pretest	1	1	2	1	1	3	2	5	2	6	4	-	3		2	2	35
Frequency Posttest						1	1	-	-	1	4	2	3	6	5	12	35

Frequency statistics quantify the frequency with which a variable occurs, for example, the number of males and females in a sample or population. Frequency analysis is an essential field of statistics that deals with the number of occurrences (frequency) and percentages. Based on Table 4.5 the lowest pre-test score was 4 while the lowest post-test score was 10. On the other hand, the highest score for both pre-test and posttest were 20, with a higher number of students who achieved this high score shown in posttest are 12 compared to pre-test are 2. This indicate that minimum score increase from 4 to 10 and total student score 20 marks which is highest score increase from 2 students to 12 students after using DFA.

4.5 Normality Test

According to Rahman and Ali (2006), the data is normally distributed when the skewness value is less than (± 1.96), and the kurtosis does not exceed (2.00). Thus, the skewness and kurtosis tests conducted in this study reveal that the data collected were normally distributed (Table 4.6). According to Lehmkuhl (1996), to apply the parametric tests of significance, the collected data should meet assumptions such as the normal distribution of the collected data.

Table 4.6

Normality Test

The Test	N	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Pre-test	35	4	20	12.91	3.921	-0.162	-0.194
Post test	35	10	20	17.74	2.582	-1.394	1.790

4.6 Paired Sample T-test Scores

When $p\text{-value} < 0.05$, a statistically significant difference was regarded. Thus, in this study, the $p\text{-value}$ is equal to or less than 0.05, which is 0.000 as shown in Table 4.7 showing that from the score, there are significant differences in student performance finally, the summary of the findings answering the research questions in Chapter 1.

Table 4.7

Paired Sample T-test Scores

The Test	Mean	N	Std Dev	T.value	p.value
Pre-test	12.91	35	3.921	-9.128	0.000
Posttest	17.74	35	2.582		

4.7 Reliability of QUIS

Reliability analysis, shown in Table 4.8, indicates that the QUIS Cronbach's alpha value is 0.902 was higher than 0.7 clarify the QUIS of this study achieved a reasonably high level of reliability. Values suggest that the questionnaire is reliable based on George and Mallery's thumb rule (2003) as shown in Table 3.3.

Table 4.8

Reliability Statistics of QUIS

The Cronbach's Alpha	N of Item
0.902	14

Referring to Table 4.9, the five items meet a certain level of reliability and accuracy, suggesting that their credibility is very high. In addition, the Likert 9-point scale is used in this questionnaire. Referring to Table 4.9, the participants' average satisfaction in the mean score for five items is approximately 8. In particular, the highest score of

the five items is screen item and the lowest score is item terminology and system information. Thus, the DFA satisfying the participants.

Table 4.9

Statistical Analysis of QUIS

Construct	N	Mean	SD
Overall reactions to the application	35	8.17	0.63
Screen	35	8.35	0.65
Terminology and system information	35	8.11	0.67
Learning	35	8.25	0.75
Usability and user interface	35	8.20	0.99

4.8 Research Findings Summary

The student's performance and perceived satisfaction analysis showed that DFA has a significantly positive influence on the student's performance and perceived satisfaction. This can be seen by the statistical findings that the students who used DFA obtained scores notably higher in post-test compared to their pre-test.

Table 4.10

Summary of the Research Findings

H0	Hypothesis	Test of Significant	Finding (Textual presentation)	Finding
H01	The is no significant improvement on the student's vocabulary mastery after using DFA	$p = 0.000$ ($p < 0.05$) (significant)	Post-test results varied significantly from pre-test results.	Posttest Scores > Pre-test Scores

In Table 4.10, it is shown that the p-value is 0.000, which is less than 0.05. Therefore this result is significant. There is no significant improvement on the student's vocabulary mastery after using the DFA. Hence, Hypothesis H_{01} , has failed to be accepted. These results explain that student vocabulary mastery improve after using the DFA.

4.9 Summary

This chapter presented the findings from an analysis of the impacts of DFA on foreign students' English vocabulary mastery and perceived satisfaction with learning English vocabulary. These findings indicate that students who had used DFA significantly scored higher in their posttest than in the pre-test.

Furthermore, the following chapter interprets empirical results. Additionally, the DFA's impact on students' performance and perceived satisfaction with learning

materials are discussed. Lastly, suggestions for future improvements are presented in the next chapter.



CHAPTER FIVE

DISCUSSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter will debate findings concerning the research question, research hypotheses, and analysis in light of existing studies and theories. The results summary is broken down into three parts; the first part discusses research based on experimental analysis, this involves the DFA's impact on the dependent variable, which is student performance and perceived satisfaction. The second part presents the effect of the study in enhancing knowledge and on perceived satisfaction of knowing English vocabulary, the third part discusses the study's limitations and makes recommendations for further research. Finally, the summary and conclusion of the study are discussed.

5.2 Research Findings Discussion

For this study, the sample consists of 35 undergraduate foreign students from a public university in Malaysia. Two tests; Pre and Post, were set side-by-side for their significance of differences in the learning materials' performance and perceived satisfaction features was measured using the QUIS questionnaire.

5.2.1 Effects of DFA on Student's Vocabulary Mastery

According to Mayer's multimedia principle, the DFA was designed using pictures and text. Generally, DFA had positive effects on the improvement of students'

performance. The statistical findings show an improvement in mean scores for the performance evaluation.

It was found that compared to their pre-test, the students who used DFA recorded substantially higher performance scores in the post-test. This indicates when they used DFA, the student acquired more vocabulary knowledge. That's also compatible with Mayer's CTML (2001). Mayer indicates that people retain information more effectively at learning when words and images are integrated than just text.

Many studies on providing the proposed English vocabulary apps encourage students' motivation on learning mastery vocabulary, cultivate students' self-learning habits, provide a ubiquitous learning environment, develop students' confidence in language learning and achieve Cognitive Theory of Multimedia Learning (CTML) (Wang, 2017). An emphasis on incorporating digital flashcards into collaborative classroom activities and the value in learning vocabulary using digital flashcards instead of more traditional methods (Hung, 2012).

In short, the combination of words and pictures in the multimedia principle of this study revealed that the students could obtain more knowledge of English vocabulary. This contributes to establishing that multimedia can affect learners' improvement.

5.2.2 The Effects of DFA in Perceived Satisfaction

In this study, a student's perceived satisfaction scores measured using the QUIS questionnaire revealed that the student was satisfied while using the DFA. Integration

between similarity and multimedia principles in the DFA show high score in perceived satisfaction as discuss in section 4.7.

5.3 The Research Implications

The discussion of the outcomes of this study has significant implications for the ability to incorporate persuasive technology and multimedia learning into the design of applications in enhancing knowledge and on perceived satisfaction of knowing English vocabulary. There are three crucial implications for this study.

5.3.1 Multimedia Principle

The research findings showed that the students could acquire more knowledge in learning English vocabulary and perceived satisfaction while using DFA. Multimedia Principle explains how people know more from text and images than from text alone. Consequently, This study contributes to establishing that Multimedia can affect students' knowledge in learning English vocabulary and perceived satisfaction.

5.3.2 Persuasive Multimedia (Similarity principle)

Integrating macro and micro strategies in DFA development shows the viability of using the design strategies to DFA (Azliza & Wan Ahmad Jaafar, 2014). The macro strategy in this study includes the principles of persuasion of Fogg (2003), such as similarity in the design and development of DFA as persuasive strategies in increasing students' mastery English vocabulary. In designing the DFA, similarity principle is applied through the use of similar content and learning environment. Metaphors of textbook and flashcard in the DFA are ensured to mapping learners with their familiar

environment. In contrast, Multimedia Principle (Mayer, 2009) is a micro strategy tested in this study, based on Mayer's Cognitive Theory of Multimedia Learning (Mayer, 2001) to present learning content effectively. It is possible to extend these design ideas to additional multimedia learning apps that use persuasive concepts and multimedia as a guideline, which would be highly suitable.

5.3.3 Digital Flashcard Application DFA

The findings present significant results in increasing students' performance in learning English vocabulary. This study also shows that DFA is a learning material in increasing student's performance in mastery English vocabulary. Ultimately, the study's effect would help encourage students to improve their knowledge of English vocabulary and establish a motivational force to participate in their learning behaviour.

5.4 Study Limitation

The following are several limitations that could restrict the possibility of generalizing this study's findings. First, the evaluation study sample was limited to the undergraduate foreign Intensive English Program students of Universiti Utara Malaysia (UUM). Second, the instruction and lessons used in the DFA was based on the Intensive English Program module and it is for this course only.

5.5 Recommendations for Future Study

The study has posed some interesting problems which require more analysis. Firstly, the study sample is limited to the undergraduate foreign Intensive English Program students of Universiti Utara Malaysia (UUM). Therefore, this research suggests that

future investigations could also be applied to postgraduate and undergraduate local students to demonstrate the benefit of utilizing DFA to improve students' English vocabulary knowledge; future studies might be expanded to a larger sample size.

Second, the suggested framework requires additional designs and the development of various forms of persuasive technologies coupled with multimedia learning (theoretical framework and instructional development model). In this study, similarity principle one of persuasive principle and the Multimedia principle one of Mayer's multimedia design principles are integrated into designing and developing DFA. Consequently, future studies might investigate and consider other persuasive principles and Mayer's multimedia design principles.

Lastly, this study is confined to determining the effects of DFA on international students' English vocabulary mastery and perceived satisfaction with the English vocabulary learning process. Furthermore, the variable explained in this study involves students' performance and perceived satisfaction in learning that may be affected by other variables, such as different learning strategies, other subject content, and gender. Therefore, these variables could be made up of in future studies.

5.6 Summary

The study aims to design, develop, and compare the impact of DFA on international students' English vocabulary mastery and students' perceived satisfaction in learning English vocabulary. The DFA's design and development produce a theoretical design framework that may help other persuasive multimedia learn applications to design and develop.

Generally, this study finding shows that DFA has increased students' comprehension of learning English vocabulary. This shows the usefulness of DFA as a substitute and an innovative solution for expanding the student's understanding of learning English vocabulary. The findings showed that students who utilized DFA performed significantly higher on their Post-test than on their Pre-test.



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Appendix A

Preliminary Investigation Interview Questions

- 1) How long have you been teaching English for an intensive English program?
- 2) What is the range age of a student attending your class?
- 3) Which country?
- 4) Do you have any problem teaching students from
- 5) Do you think students are concerned about studying English?
- 6) What normally problems do they face?
- 7) What should students do to improve their English language skills such as reading, writing, speaking and listening?
- 8) Do you think vocabulary is an important part of language learning?
- 9) Do you think that students are concerned about studying English language vocabulary? Why?
- 10) Can the students distinguish all English vocabulary? Why?
- 11) In general, what are current strategies used to teach English language vocabulary?

- 12) Which methods do you use in teaching English vocabulary?
- 13) Could you please name a few books that you use in teaching English vocabulary?
- 14) Do you use any aids in teaching English language vocabulary? If yes, please explain? Is it effective?
- 15) Do you use flashcards in vocabulary teaching?
- 16) What do you think is the solution to solve this problem?
- 17) Do you agree that technology could help students increase their English vocabulary?
- 18) Do you want to use new technologies to educate and entertain students?
- 19) What are the important features or content which you would like to see more employed in applications targeting students?

Appendix B

Tran-scripting Preliminary Investigation Interview

Q1. How long have you been teaching English for an intensive English program?

Assalamualaikum

My name is Rohaiza

I have already been teaching English for about 27 years, but specifically for the Intensive English Program for almost ten years.

Q2. What is the range age of a student attending your class?

The undergraduate student, my experience teaching English for the Intensive English Program many times that I have taught I think as I said ten years and the age that I teach them at that group is about 20 something 20 - 24 around that age.

Q3. Which country?

Most of them are from middle east countries. It consists of Jordan, Yemen, Libya and sometimes from Indonesia.

Q4. Do you have any problem teaching students from these countries?

If you are saying a problem, I have to ask you what type of problems, if you talk from a linguistic view like us there are many types of problems, vocabulary is a problem, but also there are more important that students have difficulty pronouncing the words

for example, because when you come to pronounce the word people can understand you, but if want look specifically vocabulary I can say that many of them do have some words simple vocabulary that they can use people so that cannot face so much problem but students from China not because of vocabulary but because of the pronunciation it is difficult to understand. With Arabic students, for example, basic communication was ok, vocabulary problems came only when they had to write or to read then only I realized that they did not understand certain words because they did not have in their mind that's why I'm saying that they do not have words. That is why when they do not have the word when they read, for example, they cannot understand.

Let me just make it clear I am not saying that it is not a vocabulary problem actually it is a problem, but there is another problem just as I said like a pronunciation for most of the time you want to speak with somebody basic communication I think many students do know just the matter of conveying the simple message one some people do know all those basic words, but I can understand that sometimes when it is more, and you think what is the words I want to use that's going to be a problem when there level going up and sometimes to me is not that big word but to the students yes because they have not used it often so they find it difficult.

Q5. Do you think students are concerned about studying English?

Yes, many of them have this concern.

Q6. What normally problems do they face?

Pronunciation, lack of vocabulary and often use the new words and practice them.

Q7. What should students do to improve their English language skills such as reading, writing, speaking and listening?

I will advise students to read a lot because when you read, you will enhance your vocabulary also you will see how grammar is used. Nowadays I know that because of the advance of information technology people does not use books anymore, they read online, well reading online is still ok. Secondly is to practice the language to use the language it means something not just to yourself, use it with your lecturers or your classmate, but for vocabulary, I advise you to read the dictionary, but nowadays people do not use a dictionary if you want to understand a new word or the meaning of the word you just google it or by using apps. This is my opinion if you ask another person, they will have other suggestions.

Q8. Do you think vocabulary is an important part of language learning?

Yes, but I will not say 100 per cent. I would say maybe 50-40 % because I have said grammar is more important to me because you cannot say the sentence if you do not know how to use the word plus word. Of course, in order for you to use the grammar, you need to know the words which are actually vocabulary.

Q9. Do you think that students are concerned about studying English language vocabulary? Why?

Yes, know that many students actually say, that oh, I cannot speak because I do not have enough vocabulary, most of the time they will say that, and I would tell them, first of all, you learn how to speak first simple and practice it only then read and only

then you have to learn that vocabulary and practice it and read a lot of books. And read dictionary but nowadays people not read dictionary I will just tell them you hear a word from the internet when listening to the song or watching movie anything on the internet in English, try to check that new word, what is it and try to look at it or at that word definition and how been used. And practice by yourself. Yes, many people do not do that.

Q10. Can the students distinguish all English vocabulary? Why?

Sometimes is a problem for them because some of the words they see in the books are new and words that are not familiar to them; when I teach them the word and explain it today in the next two weeks, I ask them again they will not remember because they do not use that word they know the word and meaning and definition and they keep it somewhere in their mind and then come in two weeks' time because they do not use it the forget it or they cannot recall it.

Q11. In general, what are current strategies used to teach English language vocabulary?

Look at the dictionary or look online the meaning and use it, but in school something different they use apps, tools and software to make students really understand what the word is, but when we talk about Intensive English Program, we do not have the time to prepare these things, so most of the time we will make some fun quiz. Such as spelling the word, guessing the meaning and through an exercise, that is all that normally does.

Q12. Which methods do you use in teaching English vocabulary?

It depends on the student and time that I have and because of who they are. For undergraduate students, I do some quizzes such as guessing the meaning and guessing from the context, but we do not have that much time. We have to fill the full number of hours.

Q13. Could you please name a few books that you use in teaching English vocabulary?

The same books that are used for teaching reading and dictionaries.

Q14. Do you use any aids in teaching English language vocabulary? If yes, please explain? Is it effective?

For the Intensive English Program, I am sorry because I do not have the time. Because we have a lot of things that we need to teach.

Q15. Do you use flashcards in vocabulary teaching?

No, not for this Intensive English Program student at this age.

Q16. What do you think is the solution to solve this problem?

Read a lot because when you read, you will enhance your vocabulary. Also, you will see how grammar is used and practice the language to use the language.

Q17. Do you agree that technology could help students increase their English vocabulary?

Yes, I think it does, but the matter is knowing the right technology and using it.

Q18. Do you want to use new technologies to educate and entertain students?

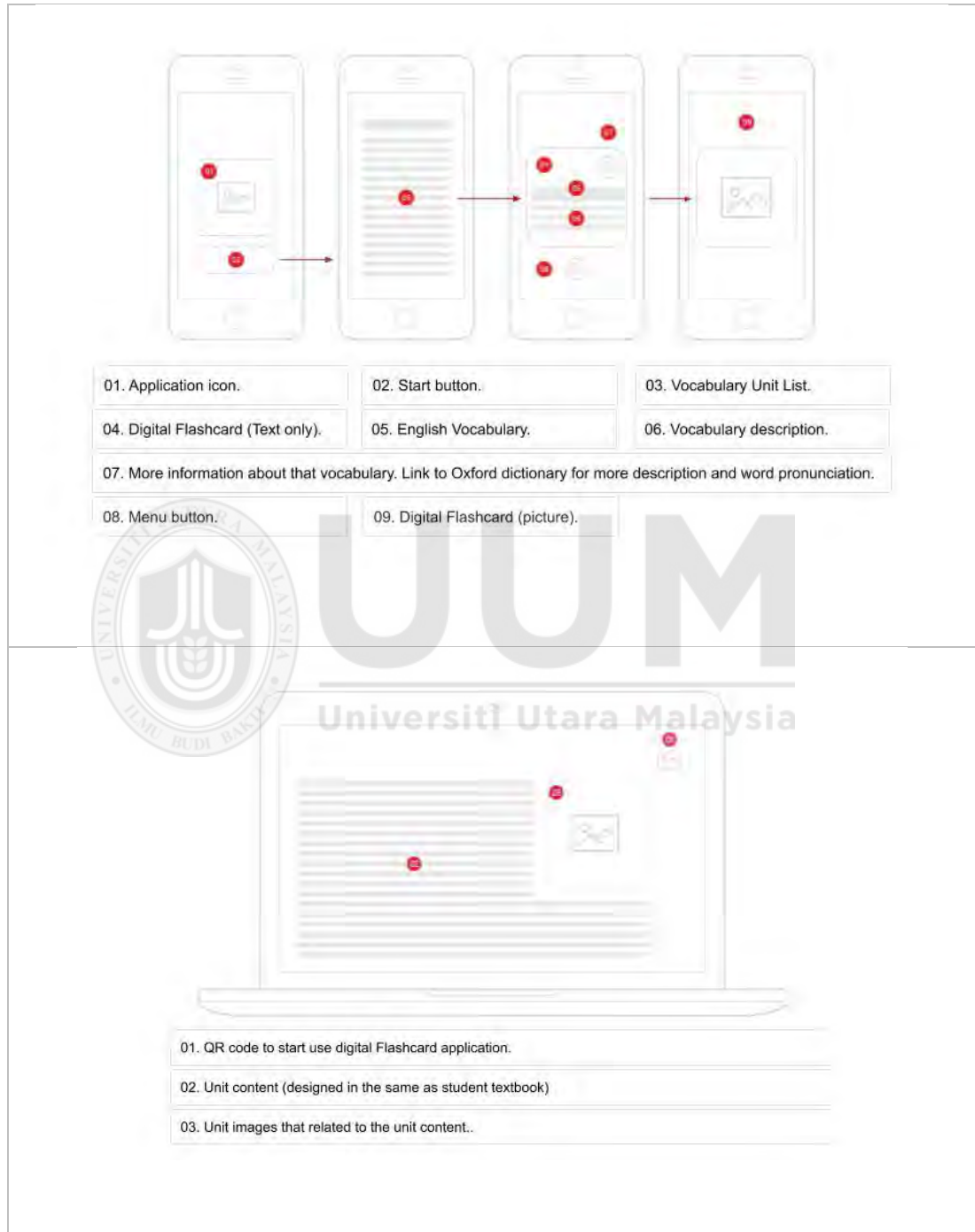
Yes, if there is a simple one, but it must be something interesting and useful.

Q19. What are the important features or content which you would like to see more employed in applications targeting students?

I will suggest visuals are very important because when you learn vocabulary to me if that word can be presented through visual and image for example, that it must be there to help people to remember, but there are words called abstract words that most of them are difficult to present by picture. I would like to see a word description and use of it or a sample of sentences. It sounds like the word (pronunciation, of course) you must have. If you have an application, I would like a dictionary, but it must be a simple one. Simple, clear, simple to use, interesting and captures student attention and must be user friendly in terms of navigation.

Appendix C

Digital Flashcard Application (DFA) Storyboard



Appendix D

Vocabulary Test (VT)

Section A: Demographic information

Your Name		Country	
Gender	Male		Female

Section B: Vocabulary Test

Q1	A set of rules or instructions that are given by an official organization telling you how to do something, especially something difficult.				
1	law	2	Information	3	Guidelines

Q2	The small hard seeds of food plants such as wheat, rice, etc.; a single seed of such a plant				
1	Vitamins	2	Proteins	3	Grains

Q3	To tell somebody that something is good or useful, or that somebody would be suitable for a particular job, etc.				
1	Rated	2	Recommend	3	Convinced

Q4	Connected with one particular thing only				
1	Scope	2	Specific	3	Significant

Q5	To advertise a product to a certain group of people				
1	Sales	2	Target	3	Advertisement

Q6	A place, person or thing that you get something from				
1	Result	2	Source	3	Outcome

Q7	Physical energy, ability to do physical things				
1	Strength	2	Powerlessness	3	Muscles

Q8	An imaginary line through the centre of an object, around which the object turns				
1	Axis	2	diameter	3	circle

Q9	To make a system, methods, etc. more modern and more suitable for use at the present time				
1	Update	2	Modernize	3	Antique

Q10	A substance found within all living things that form the structure of muscles, organs, etc.				
1	Grains	2	Protein	3	Vitamins

Q11	A feeling of needing to eat				
1	Fullness	2	Hunger	3	Thirsty

Q12	One part of something				
1	Element	2	Compound	3	Detail

Q13	To organize the sale of something				
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1	Product	2	Market	3	Goods
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Q14	A piece of paper, etc. that is attached to something and that gives information about it				
1	Note	2	Advertisement	3	Label

Q15	A plan to achieve something				
1	Ambition	2	Goal	3	Strategy

Q16	An amount of food for one person				
1	Meal	2	Diet	3	Servings

Q17	To seem interesting or attractive				
1	Retraction	2	Handsome	3	Appeal

Q18	A diagram consisting of a circle that is divided into sections to show the size of particular amounts in relation to the whole				
1	Line graph	2	Bar graph	3	Pie chart

Q19	Cause something to begin or develop				
1	Build	2	Stimulates	3	development

Q20	A diagram that uses lines or narrow rectangles of different heights (but equal widths) to show different amounts so that they can be compared				
1	Line graph	2	Pie chart	3	Bar graph

Appendix E

Questionnaire for User Interface Satisfaction (QUIS)

Item 1: Overall user reactions

Q 1	Overall reactions to the application									
Difficult	1	2	3	4	5	6	7	8	9	Easy
Frustrating	1	2	3	4	5	6	7	8	9	Satisfying
Dull	1	2	3	4	5	6	7	8	9	Stimulating
Rigid	1	2	3	4	5	6	7	8	9	Flexible
Terrible	1	2	3	4	5	6	7	8	9	Wonderful

Item 2: Screen

Q 1	Elements on the mobile screen									
Hard to Read	1	2	3	4	5	6	7	8	9	Easy to Read

Q 2	Organization of information on the screen									
Confusing	1	2	3	4	5	6	7	8	9	Very Clear

Q 3	Sequence of screens									
Confusing	1	2	3	4	5	6	7	8	9	Very Clear

Item 3: Terminology and system information

Q1	Use of terms throughout the system									
Inconsistent	1	2	3	4	5	6	7	8	9	Consistent

Q2	Mobile terminology is related to the task you are doing									
Never	1	2	3	4	5	6	7	8	9	Always

Q3	Position of messages on screen									
Inconsistent	1	2	3	4	5	6	7	8	9	Consistent

Item 4: Learning

Q1	Learning to operate the system									
Difficult	1	2	3	4	5	6	7	8	9	Easy

Q2	Tasks can be performed in a straight-forward manner									
Never	1	2	3	4	5	6	7	8	9	Always

Item 5: Usability and user interface

Q1	Use of colours and sounds									
Poor	1	2	3	4	5	6	7	8	9	Good

Appendix F

Multimedia Design Principles (by Mayer, 2001)



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12 Principles of Multimedia Learning

If you are designing a PowerPoint presentation, developing an online course or preparing to flip your classroom, you may need to reconsider how you will get students to engage with the material without the traditional face-to-face interaction. In the book *Multimedia Learning* (Cambridge Press, 2001), Richard E. Mayer discusses twelve principles that shape the design and organization of multimedia presentations:

1. **Coherence Principle** – People learn better when extraneous words, pictures and sounds are excluded rather than included.
2. **Signaling Principle** – People learn better when cues that highlight the organization of the essential material are added.
3. **Redundancy Principle** – People learn better from graphics and narration than from graphics, narration and on-screen text.
4. **Spatial Contiguity Principle** – People learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.
5. **Temporal Contiguity Principle** – People learn better when corresponding words and pictures are presented simultaneously rather than successively.
6. **Segmenting Principle** – People learn better from a multimedia lesson is presented in user-paced segments rather than as a continuous unit.
7. **Pre-training Principle** – People learn better from a multimedia lesson when they know the names and characteristics of the main concepts.
8. **Modality Principle** – People learn better from graphics and narrations than from animation and on-screen text.
9. **Multimedia Principle** – People learn better from words and pictures than from words alone.
10. **Personalization Principle** – People learn better from multimedia lessons when words are in conversational style rather than formal style.
11. **Voice Principle** – People learn better when the narration in multimedia lessons is spoken in a friendly human voice rather than a machine voice.
12. **Image Principle** – People do not necessarily learn better from a multimedia lesson when the speaker's image is added to the screen.

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