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MUETBOT: DESIGNING AND DEVELOPING CHATBOT TO SUPPORT THE LEARNING OF MUET READING SKILLS

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DEDICATION

I dedicate my dissertation work to my beloved parents, mentors and friends who shared their words of advice and encouragement to finish this study.

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ABSTRACT

The study aims to design and develop a chatbot named MUETBot to support the learning of MUET reading skills. This study loosely employs multiphase mixed methods combined with Richey and Klein's Design and Development Research (DDR) approach in constructing MUETBot. The study was conducted in three phases, namely need analysis, design and development, and evaluation phase. To identify the difficulties faced by ESL students in MUET reading skills, a needs analysis questionnaire was administered to 150 MUET test-takers in Phase 1. Phase 2 adopted the Fuzzy Delphi Method (FDM) to identify the functionalities of MUETBot via a panel of 13 experts. In Phase 3, the validity and reliability of the developed MUETBot were obtained via content validation by five experts and User Acceptance Test by 30 students. The researcher investigated the effectiveness of MUETBot in supporting the learning of MUET reading skills among 80 university students through pre and post MUET reading tests followed by a semi-structured guided interview. The overall findings for Phase 1 revealed that the majority of students faced challenges in extracting relevant information for argument, managing time, and understanding the meaning of words. Findings from Phase 2 using FDM resulted in the development of MUETBot that consisted of 5 main menus: Exam format, note, practice, quiz, and ask me. In Phase 3, the findings based on the achievement in pre and post MUET reading tests revealed that there was a significant difference $t(39)=.000$, $p < .05$ in the MUET reading skills of students involved in the MUETBot intervention. Student responses from the interview indicated a positive attitude toward MUETBot, emphasizing its convenience and effectiveness in practicing MUET reading skills. This implies that MUETBot is a suitable learning support for MUET reading skills. The developed MUETBot can be adapted to other courses in future studies, and its evaluation can involve different participants.

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MUETBOT: MEREKABENTUK DAN MEMBANGUNKAN CHATBOT UNTUK MENYOKONG PEMBELAJARAN KEMAHIRAN MEMBACA MUET

ABSTRAK

Kajian ini bertujuan untuk mereka bentuk dan membangunkan chatbot bernama MUETBot untuk menyokong pembelajaran kemahiran membaca MUET. Kajian ini secara longgar menggunakan kaedah campuran berbilang fasa digabungkan dengan pendekatan Penyelidikan dan Penyelidikan Pembangunan (DDR) Richey dan Klein dalam membina MUETBot. Kajian ini dijalankan dalam tiga fasa iaitu analisis keperluan, reka bentuk dan pembangunan serta fasa penilaian. Untuk mengenal pasti kesukaran yang dihadapi oleh pelajar ESL dalam kemahiran membaca MUET, soal selidik analisis keperluan telah diberikan kepada 150 peserta ujian MUET dalam Fasa 1. Fasa 2 menggunakan Kaedah Fuzzy Delphi (FDM) untuk mengenal pasti fungsi MUETbot melalui panel 13 pakar. Dalam Fasa 3, kesahan dan kebolehpercayaan MUETBot yang dibangunkan diperoleh melalui pengesahan kandungan oleh lima pakar dan Ujian Penerimaan Pengguna oleh 30 pelajar. Pengkaji menyiasat keberkesanan MUETBot dalam menyokong pembelajaran kemahiran membaca MUET dalam kalangan 80 pelajar universiti melalui ujian pra dan pasca MUET membaca diikuti dengan temu bual berpandu separa berstruktur. Penemuan keseluruhan untuk Fasa 1 mendedahkan bahawa majoriti pelajar menghadapi cabaran dalam mengekstrak maklumat yang relevan untuk hujah, mengurus masa dan memahami makna perkataan. Penemuan daripada Fasa 2 menggunakan FDM menghasilkan pembangunan MUETBot yang terdiri daripada 5 menu utama: Format peperiksaan, nota, latihan, kuiz, dan tanya saya. Dalam Fasa 3, dapatan berdasarkan pencapaian dalam ujian bacaan pra dan pasca MUET menunjukkan terdapat perbezaan yang signifikan $t(39)=.000$, $p < .05$ dalam kemahiran membaca MUET pelajar yang terlibat dalam intervensi MUETbot. Maklum balas pelajar daripada temu bual menunjukkan sikap positif terhadap MUETBot, menekankan kemudahan dan keberkesanannya dalam mempraktikkan kemahiran membaca MUET. Ini menunjukkan bahawa MUETBot ialah sokongan pembelajaran yang sesuai untuk kemahiran membaca MUET. MUETBot yang dibangunkan boleh disesuaikan dengan kursus lain dalam kajian masa depan, dan penilaiannya boleh melibatkan peserta yang berbeza.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
API	Application Programming Interface
CAL	Computer-Aided/Assisted Learning
CEFR	Common European Framework of Reference
Chat GPT	Chat Generative Pre-Trained Transformer
CMC	Computer-Mediated Communication
CML	Chatbot-Mediated Learning
DDR	Design and Development Research
EFL	English as a Foreign Language
ESL	English as Second Language
ESP	English for Specific Purposes
FDM	Fuzzy Delphi Method
ICT	Information and Communications Technology
IELTS	International English Language Testing System
ITS	Intelligent Tutoring System
LLM	Large Language Model
L2	Second Language
MCQ	Multiple Choice Question
MEC	Malaysian Examinations Council
MMR	Mixed Method Research
MOE	Ministry of Education
MUET	Malaysian University English Test
NLP	Natural Language Processing

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NLU	Natural Language Understanding
OHP	Overhead Projector
SLA	Second Language Acquisition
SPSS	Statistical Package for Social Science
STPM	Sijil Tinggi Pelajaran Malaysia
TESL	Teaching English as a Second Language
TML	Technology-Mediated learning
TOEFL	Test of English as a Foreign Language
TOEIC	Test of English for International Communication
TPACK	Technological Pedagogical Content Knowledge
UAT	User Acceptance Testing
ZPD	Zone of Proximal Development

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APPENDIX LIST

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J	Semi-Structured Interview Questions
K	Student Verification for Conducting Research
L	Consent to Validation of Research Instrument
M	Needs Analysis Questionnaire Expert Validation Form
N	Expert Agreement Questionnaire Expert Validation Form
O	Pre And Post Muet Reading Tests Expert Validation Form
P	Semi-Structured Interview Expert Validation Form
Q	User Acceptance Test Questionnaire Expert Validation Form

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CHAPTER 1

INTRODUCTION

1.0 Introduction

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This chapter explains the background of the study, the statement of the problem, the rationale of the study, the objectives of the research, the research questions, the research hypotheses, the conceptual framework of the study, the operational definitions of the terms used, the limitations of the study, and the significance of the study.

1.1 Background of the Study

In this age of globalization, the need for educational technology in transforming and enhancing education quality is recognized unequivocally (Burbules et al. 2020; Escueta et al., 2020). The effective use of technologies in and outside classrooms has expanded the impact of effective teaching and learning practices in 21st-century

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education. With the launch of the Malaysia Education Blueprint 2013-2025, the Ministry of Education (MOE) has made substantial progress in leveraging technology to transform teaching and learning in various ways (Zhang et al. 2023). Various sophisticated software and applications are adopted to adapt assessments and instruction to individual learners' needs and abilities. 21st-century teachers utilize educational technologies to personalize learning (Huang, 2019) and provide students more opportunities to choose what and how they learn, preparing them to organize and direct their own learning for the rest of their lives (Ibna Seraj & Oteir, 2022).

The evolution of technology continues to drive educational capabilities to higher levels. Looking at where teaching methodologies and technologies originated from and where they are going in time to come, the value and importance of classroom technology are obvious now more than ever. Dakhi et al. (2020) posited that the advancements and developments in educational technologies have contributed to enhancing teaching methodologies and tools in this 21st century compared to primitive classrooms. Beginning with the overhead projector (OHP) in the older days, AI assistants and chatbot applications are now evolving to substitute older devices and expand in all fields.

Technology has practically become an integral component of many aspects of educational delivery in our contemporary digital age (Kucuk, 2023; Rahmatullah et al., 2022). Artificial intelligence (AI) has existed for decades. Nonetheless, it has only lately become an accessible resource and assistance for everyday activities on our cell phones, as well as for English language teaching (Sun et al., 2021). Alamri et al. (2021) asserted that as the education narrative shifts from a factory model towards a more personalized and customized learning, greater technology integration is required to augment the workload necessary to implement personalized learning. Hence, teachers

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and educators must modify and alter the educational tools to transform the boring classroom into an engaging and enjoyable environment.

Standardized assessments of English competence and proficiency tests such as the Test of English as a Foreign Language (TOEFL), Test of English for International Communication (TOEIC), and International English Language Testing System (IELTS) have been prevalently used in higher education institutions worldwide to assess students' English language competency (Lertcharoenwanich, 2022; Raharjo, 2020; Waluyo et al., 2024). In the Malaysian context, the Ministry of Education has launched the localized version of such a test named Malaysian University English Test (MUET) since 2007 to assess English proficiency among students (Harun et al. 2021; Hamdzah et al., 2022). It is a compulsory must-take examination as an entry and exit requirement of local public (Krishnan et al., 2019).

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The Malaysian Examinations Council (MEC) is in charge of setting and administering the test. MUET is commonly recognized in Malaysia and Singapore, but only to a small extent in other countries worldwide. Besides being the compulsory test taken prior to admission to all Malaysian public universities and colleges, MUET is sometimes taken by government employees as an English certification for their career promotion (Husin & Radzuan, 2021). Starting from 2021, MUET has undergone significant format changes. The MEC made changes in the test specification for Listening, Speaking, Reading, and Writing to align MUET with the Common European Framework of Reference (CEFR). The revisions were made in collaboration with Cambridge English Language Assessment, a division of the University of Cambridge (Malaysian Examinations Council, 2019).

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The English Language Education Reform in Malaysia: The Roadmap 2015-2025 seeks to improve the English language in Malaysia through the use of the CEFR. CEFR is an international standard for language teaching and learning. It identifies five communication skills: listening, writing, reading, spoken interaction, and oral production (Malaysian Examinations Council, 2019). The CEFR classifies language competence as A1, A2 (basic users), B1, B2 (independent users), and C1, C2 (proficient users).

Malaysian students need to take a mandatory test set by the Examination Council as a prerequisite for admission to graduate studies. MUET is an English language skills test intended to assess students' English language skills in preparation for first-degree studies at local institutes of higher learning (Harun et al., 2021). English is taught at Form Six or pre-university level at MUET to ensure that students have the required level of English literacy to succeed academically at the tertiary level. MUET is mainly taken by STPM applicants, matriculation students, diploma students, and pre-university students before enrolling in the first-degree program at local institutions. MUET is held on a triennial basis in March, July, and November. MUET consists of four components and papers: Listening (800/1), Speaking (800/2), Reading (800/3), and Writing (800/4). MUET categorizes candidates into six bands or levels of proficiency, ranging from very proficient users (Band 5+) to very limited users (Band One).

Based on the statistics (MEC, 2020) published on the official portal of MEC for MUET March 2019 session, among 49,081 candidates who took the test, 1.56% of candidates scored Band 1; 28.85% candidates achieved Band 2; 48.79% of the candidates obtained Band 3; 19.67% candidates scored Band 4; only 1.12% candidates achieved Band 5, and 0% of candidates managed to achieve Band 6. This

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indicates that the majority of the test takers are only modest and limited English users who lack fluency and appropriacy (MEC, 2020), with the ability to understand English but with some misinterpretation. Among those, only 32% achieved Band 4 and above for the 800/3 Reading paper. This illustrates that reading is the biggest hindrance for the candidates to achieve higher bands in MUET. This is supported by Rozana (2020), who has reported that reading is often the most challenging for students sitting for MUET.

In tapping into the problems faced by ESL students in learning MUET reading skills, Hassan et al. (2021), Lai (2021) and Solikhah (2018) has asserted that the primary problems in learning reading skills include insufficient literacy in the general vocabulary list, grammatical complexity, academic text complexity, diverse reading habits and cultures, a lack of schemata activation, and a lack of reading motivation (Mousa & Ali, 2022; Rajasagaran & Ismail, 2022). Due to these barriers, ESL students often struggle to grasp the texts and just decode the reading materials without comprehension. Keeping this perspective in mind, reading should present readers with relevant messages derived from the texts, as the outcomes of the reading task may have an effect on the readers' attitude and perception.

1.2 Problem Statement

Despite the growing interest in integrating technology into educational practices, the exploration and application of advanced technological tools in language learning, particularly within the context of high-stakes examinations like MUET, remain underexplored (Chang & Hung, 2019; Yin & Hanif, 2024). Research on educational technology has primarily focused on general education tools and methodologies, often

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overlooking the specific needs of language learning and test preparation (Iberahim et al., 2023; Zhang & Zou, 2022). The lack of targeted technological solutions has resulted in a gap where traditional methods still dominate, leaving much of the potential for technology-enhanced learning untapped (Daniela, 2021). In the field of instructional technology education, there is an increasing need to bridge this gap by developing and implementing innovative tools that cater specifically to the challenges faced by students in mastering English language skills for MUET (Yin & Hanif, 2024).

In Malaysia, where English is considered a second language (ESL), MUET is a critical component of the Malaysian government's plan to increase English proficiency (Abu Bakar et al., 2021). MUET is an obligatory English language proficiency test taken by students before they pursue their bachelor's degree in public and private Malaysian universities and colleges (Malaysian Examinations Council, 2019). The candidates involved are STPM (Sijil Tinggi Pelajaran Malaysia), matriculation, diploma, pre-university students, and students currently pursuing their bachelor's degree (Mawan et al., 2017). Despite years of learning English in primary and secondary education, studies have shown that many students still struggle to master the language (Aziz & Kashinathan, 2021; Misbah et al., 2017; Yaccob & Yunus, 2019) and achieve unsatisfactory results in language tests (Karnine et al., 2022).

Hiew et al. (2021), Lai (2021), and Nesaratnam et al. (2020) have emphasized that poor English and unsatisfactory MUET performance have resulted in unemployment among Malaysian fresh graduates. The study conducted by Jawing and Kamlun (2022) has shown a significant relationship between English language proficiency and graduate employability among Malaysian graduates. This has raised concerns in both the government and private sectors. Nesaratnam et al. (2020) and Husin and Radzuan (2021) found that despite Malaysia's recognition of the importance

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of English, graduates from Malaysia's local universities struggle with speaking, writing, reading, and listening in English for work-related tasks. Nesaratnam et al. (2020) and Ting et al. (2017) affirmed that private companies and businesses, including global corporations and foreign subsidiaries, are looking for graduates majoring in or proficient in English communication. Companies believe that highly qualified graduates who are proficient in English communication will perform more successfully to increase productivity. According to Darmi and Albion (2013), 50 private businesses in Selangor and Perak hire employees depending on their English language proficiency. Hence, there is an urgent need to conduct comprehensive research on the matter to find the "right medicine" to curb the decline in the English level (Nesaratnam et al. 2020).

Several factors contribute to the stagnation in MUET performance despite continuous efforts to improve it. Firstly, current MUET materials are limited to books, worksheets, and online resources, which limits students' understanding of the techniques required to score in the four components of MUET. While these materials provide students with ample knowledge on format, their performance in the test is mainly determined by their competency in using the language for listening, reading, speaking, and writing. With limited accessible MUET assistance, it is challenging for students to excel in MUET.

Moreover, the limited engagement time for MUET preparation classes in schools and higher education institutions contributes to unsatisfactory performance. Although the MUET program should encompass 240 hours of instruction time (MEC, 2020), teachers in most schools focus more on other subjects than teaching English to students. Additionally, students in Foundation and Matriculation programs are not given formal MUET classes before sitting for MUET, and undergraduates who need to

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resit for MUET in universities and colleges have limited access to English proficiency classes.

Therefore, there is a need for a new technological approach to solving the problem, such as intelligent tutoring systems (Ni & Cheung, 2023), web-based tutorials (Bashori et al., 2022), and chatbots (Annamalai et al., 2023). Among these options, chatbots are the most suitable technology to adapt to the situation (Huang et al., 2022). By using cutting-edge chatbots to facilitate self-directed MUET learning, students can practice whenever and wherever they are. This will revolutionize the MUET teaching and learning process and boost students' performance.

Chatbots can perform assessments at home or in the classroom, and the transcripts of these conversations can help teachers learn more about their students' needs and suggest suitable lesson plans. Language teachers play a significant role in the development of these chatbots, ensuring that the syllabi meet the necessary criteria for students preparing for language competence tests.

Although previous researchers have studied chatbots, few have integrated them into English language learning (Wahyuni, 2022; Huang et al., 2022; Chuah & Kabilan, 2021), specifically in the context of the Malaysian University English Test. This gap makes it challenging to find a chatbot that specifically caters to the teaching and learning of MUET. Therefore, this study aims to provide students with the opportunity to experience and prepare for MUET beyond the classroom by introducing the use of chatbots to support the teaching and learning of MUET.

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1.3 Rationale of the Study

In recent years, chatbots have emerged as transformative tools in the field of education technology. These intelligent computer programs can communicate with learners, offering a unique platform to support and enhance the teaching and learning process. By leveraging chatbots in the context of MUET teaching and learning, English educators can empower students to engage in self-directed learning. Despite the limited research on the effectiveness of chatbots in assessing students' English skills, there is a notable interest in their development, indicating their potential to revolutionize English language learning (Fryer et al., 2020; Nuria, 2019; Winkler & Söllner, 2018).

The increasing importance of proficient English skills in the workforce is undeniable, with many companies and employers now prioritizing candidates with strong English proficiency (Lan, 2022). This trend underscores the urgency of enhancing Malaysian students' performance in the Malaysian University English Test (MUET), a standardized test that assesses English language proficiency. However, there are significant challenges in achieving this goal, including limited access to comprehensive teaching materials and constrained instructional time in schools. To address these challenges, there is a pressing need to develop innovative technologies that can enable students to self-learn MUET skills anytime and anywhere.

This study seeks to investigate the process through which MUET test-takers acquire reading skills and assess the impact of chatbot technology on this process. By examining the interaction between learners and the chatbot, as well as its effects on the learning process, the researcher aims to shed light on the role of technology in enhancing English language learning. Levy (1997, p. 184) suggests that technology, when used as a tool, can augment learner capacities by amplifying existing skills or

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compensating for deficiencies. Building on this premise, the researcher endeavors to develop MUETBot, a chatbot-based teaching and learning platform for MUET reading skills.

In summary, this study addresses a critical need to improve English language proficiency among Malaysian students by leveraging innovative technologies such as chatbots. By exploring the effectiveness of MUETBot in supporting self-directed learning, this research contributes to the advancement of English language education and technology integration in the classroom.

1.4 Objectives of the Study

This study involves three phases based on Design and Developmental Research (DDR) framework by Richey and Klein (2007), namely Phase 1: Needs Analysis Phase, Phase 2: Design and Development Phase, and Phase 3: Evaluation Phase. The objectives of each phase are as follows:

Phase 1: Needs Analysis Phase

1. To identify the components that ESL students find challenging in MUET reading skills.

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Phase 2: Design and Development Phase

2. To identify the suitable functionalities of chatbot to support the learning of MUET reading skills.

Phase 3: Evaluation Phase

3. To determine the validity of MUETBot.

4. To determine the reliability of MUETBot.

5. To investigate the significant difference in the ESL students' performance towards the use of MUETBot in supporting the learning of MUET reading skills.

6. To identify ESL students' views on the use of MUETBot in supporting the learning of MUET reading skills.

1.5 Research Questions

The study is guided by the following research questions:

Phase 1: Needs Analysis Phase

1. What are the components that ESL students find challenging in MUET reading skills?

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Phase 2: Design and Development Phase

2. What are the suitable functionalities of chatbot to support the learning of MUET reading skills?

Phase 3: Evaluation Phase

3. What is the validity value of MUETBot?

4. What is the reliability value of MUETBot?

5. Is there a significant difference in the ESL students' performance towards the use of MUETBot in supporting the learning of MUET reading skills?

6. What are the ESL students' views on the use of MUETBot in supporting the learning of MUET reading skills?

1.6 Research Hypotheses

The research hypotheses of this study are derived from Research Question 5 in Phase 3. The hypotheses are as follows:

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Hypothesis 1

H_{01} There is no significant difference in ESL students' performance between the control group and experimental group in the pre-test.

H_{a1} There is significant difference in ESL students' performance between the control group and experimental group in the pre-test.

Hypothesis 2

H_{02} There is no significant difference in ESL students' performance between the control group and experimental group in the post-test.

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H_{a2} There is significant difference in ESL students' performance between the control group and experimental group in the post-test.

Hypothesis 3

H_{03} There is no significant difference in the pre and post ESL students' performance for control group.

H_{a3} There is significant difference in the pre and post ESL students' performance for control group.

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Hypothesis 4

H_{04} There is no significant difference in the pre and post ESL students' performance for experimental group.

H_{a4} There is significant difference in the pre and post ESL students' performance for experimental group.

1.7 Conceptual Framework of the Study

Conceptual framework generally illustrates the overview of the study and highlights the essential elements of study such as constructs, factors or variables and the relationship between them (Van der Waldt, 2020). The conceptual framework of the study is illustrated in Figure 1.1.

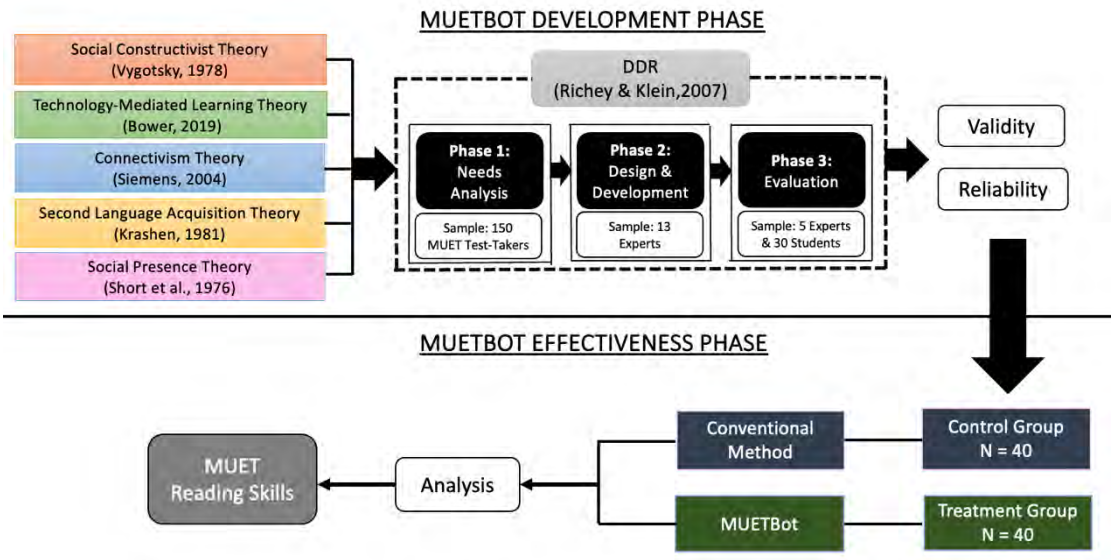

Figure 1.1. Conceptual Framework

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The study's conceptual framework comprised two main phases: the MUETBot development phase and the MUETBot effectiveness phase. In the first phase, five main theories guided the design and development of MUETBot for learning MUET reading skills: social constructivist theory, technology-mediated learning theory, connectivism theory, second language acquisition theory, and social presence theory.

Social Constructivist Theory (Vygotsky, 1978) emphasizes the importance of social interactions in learning. It posits that knowledge is constructed through interaction with others, which is crucial in language learning. This theory is interconnected with Technology-Mediated Learning Theory (Bower, 2019), which focuses on using technology as a medium to facilitate these social interactions. In the context of MUETBot, the chatbot serves as a technological tool that mediates interaction between the learner and the content, enabling a socially constructed learning experience even in a digital environment. By engaging with MUETBot, students are not only accessing content but are also engaging in a dialogic process that is central to social constructivist learning. Connectivism Theory (Siemens, 2004) further enhances this framework by introducing the idea that learning occurs across networks of information. It posits that knowledge is distributed across a network of connections, and learning consists of the ability to navigate and make sense of these connections. Within the MUETBot framework, connectivism is realized as students interact with various information nodes embedded in the chatbot, such as practice questions, reading strategies, and immediate feedback. This interconnected approach complements Second Language Acquisition Theory (Krashen, 1981), which asserts that language learning is most effective when learners are exposed to comprehensible input slightly beyond their current proficiency level. MUETBot is designed to adaptively provide this input, ensuring that students are constantly challenged yet supported, thereby facilitating language acquisition. Lastly, Social Presence Theory (Short et al.,

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1976) ties these theories together by ensuring that the chatbot creates a sense of presence, making the learning experience feel interactive and human-like. The sense of social presence in MUETBot is critical for maintaining student engagement, which is a foundational element in both constructivist and connectivist learning environments.

Together, these theories create a cohesive framework where social interaction, technological mediation, networked learning, language acquisition, and social presence are interwoven. The integration of these theories ensures that MUETBot is not just a technological tool but a comprehensive learning environment that supports students in multiple dimensions, from cognitive development to language proficiency. These theories drove the design and developmental research (DDR) of a MUETBot, which involved three main phases: the needs analysis phase, the design and development phase, and the evaluation phase. The independent variable in this study is the MUETBot intervention, which represents the implementation of the chatbot as a tool to support and enhance students' learning of MUET reading skills. The dependent variable is the improvement in MUET reading skills, which is measured through pre and post MUET reading tests administered to students.

In the needs analysis phase, a questionnaire was administered to 150 MUET test-takers to identify the specific challenges they faced in mastering MUET reading skills. The aim was to pinpoint areas where students required additional support and intervention. This initial phase provided crucial insights that guided the subsequent design and development phase, which focused on creating MUETBot. The design and development phase aimed to address the identified needs by designing a chatbot that could effectively support students in improving their MUET reading skills. Next, in the evaluation phase, the research outcome, which was the MUETBot, was tested for its

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validity and reliability to ensure that it accurately measures and enhances MUET reading skills.

For the MUETBot effectiveness phase, the effectiveness of MUETBot in enhancing MUET reading skills was assessed. This phase involved an experimental study with 80 ESL students divided into a control group and a treatment group. The treatment group received the intervention of using MUETBot, while the control group followed conventional learning methods. Pre and post MUET reading tests were conducted to measure the reading achievements of both groups, allowing for an investigation into the effectiveness of MUETBot in supporting the learning of MUET reading skills.

In conclusion, the conceptual framework of the study provided a solid foundation for the development and evaluation of MUETBot, guided by key theories in education and technology. The study's design, incorporating the needs analysis, design and development, and evaluation phases, ensured a systematic approach to addressing students' needs and assessing the effectiveness of the intervention.

1.8 Operational Definition

Below are the terms that are commonly used in this study. Some terminologies are prevalently used in the field of education, whereas some others are specifically applicable in this study.

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1.8.1 Intelligent Tutoring System

According to Cristea and Troussas (2021) and Dašić et al. (2016), intelligent tutoring systems (ITS) are massive, integrated software systems that employ artificial intelligence (AI) ideas and methods to resolve problems and fulfil teaching and learning needs. They enable students to identify models of their current knowledge levels and use learning strategies to enhance or update their understanding. The content and style of teaching topic presentations may be adapted to students' levels. They are intended to assist and enrich the teaching and learning process in the chosen field of knowledge while acknowledging the learner's diversity.

In this study, MUETBot, an ITS developed by Tang and Hafiz (2024) specifically for the learning of MUET reading skills, is a specialized application of artificial intelligence (AI) technology. The chatbot is designed to provide personalized and adaptive e-learning experiences to enhance students' mastery of MUET reading skills. MUETBot utilizes AI algorithms to analyze students' responses and interactions, allowing it to tailor its responses and learning materials based on individual learning needs and progress. This personalized approach aims to improve engagement, motivation, and ultimately, learning outcomes. Additionally, MUETBot offers a range of features such as practice exercises, quizzes, and real-time feedback, which are designed to enhance students' understanding and retention of key concepts in MUET reading. Through its interactive and adaptive design, MUETBot aims to provide students with a supportive and effective learning environment that complements traditional classroom instruction.

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1.8.2 Artificial Intelligence

According to Haenlein et al. (2019), artificial intelligence (AI) refers to a system's ability to correctly interpret external information, learn from it, and use that learning to achieve specific goals and tasks through flexible adaptation". Chandiok et al. (2020) define AI as the branch of computer science concerned with the design and study of intelligent computational agents.

In this study, the AI technology employed is embodied in MUETBot, a chatbot that functions as an ITS. MUETBot is designed to interact with users in a natural language conversation, simulating human-like interaction to provide information, answer questions, and assist users in learning MUET reading skills. The chatbot employs natural language processing (NLP) techniques to understand user inputs and generate appropriate responses. It uses machine learning algorithms to continuously improve its responses based on user interactions, allowing it to adapt and provide more accurate and relevant information over time. MUETBot's AI capabilities enable it to offer personalized learning experiences, tailored to individual users' needs and learning styles. Through its AI technology, MUETBot aims to enhance the effectiveness of learning MUET reading skills by providing accessible, interactive, and personalized support to users.

1.8.3 Chatbot

According to Shah et al. (2023) and Adnan et al. (2021), a chatbot is an artificial intelligence program capable of emulating human conversations, specifically within messaging apps, mobile applications, or various electronic platforms. Correspondingly,

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Nuria (2019) and Smutny and Schreiberova (2020) describe a chatbot as a computer program or artificial intelligence entity proficient in engaging users through audio or text, communicating intelligently in a defined area or subject matter. Additionally, Adamopoulou and Moussiades (2020) characterize a chatbot as software distinguished from other computer programs by its ability to simulate intelligent conversations with human users through auditory or written means.

In the context of this study, a chatbot named “MUETBot” is designed to provide a personalized and adaptive e-learning environment to enhance students' mastery of MUET reading skills. MUETBot interacts with users through natural language conversation, mimicking human-like interaction to offer guidance, explanations, and practice opportunities. It provides users with access to learning materials, practice questions, and feedback to help them improve their reading comprehension, vocabulary, and critical thinking skills needed for the MUET exam. Through its interactive features, MUETBot aims to engage users in active learning, promoting self-directed study and improving their overall proficiency in MUET reading.

1.8.4 MUETBot

MUETBot is a language learning chatbot developed to support MUET learning. With a primary emphasis on enhancing MUET reading skills, the chatbot offers an interactive learning environment where students can actively engage with diverse functionalities. Through MUETBot, students gain access to educational resources such as specialized videos addressing MUET reading skills, practice questions tailored to different parts of the test, and a vocabulary assistance feature that allows for the exploration of word meanings.

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From a technical perspective, MUETBot stands out for its development on Google Dialogflow, harnessing advanced natural language processing capabilities to comprehend and respond effectively to user inputs. Moreover, its integration into the Telegram messaging platform ensures accessibility, enabling seamless interaction with the chatbot. In essence, MUETBot emerges as a comprehensive and dynamic tool that not only aligns with the nuanced requirements of MUET preparation but also integrates cutting-edge technology to create an engaging and effective learning experience for students.

1.8.5 Malaysian University English Test (MUET)

Sukri et al. (2023) posited that the Malaysian University English Test (MUET) is an English language proficiency examination intended to assess students' language skills in preparation for undergraduate studies at local higher learning institutions. MUET is held triennially in March, July, and November, and comprises four components: Listening (800/1), Speaking (800/2), Reading (800/3), and Writing (800/4). MUET assigns candidates to one of six proficiency bands, ranging from very competent users (Band Six) to very limited users.

In this study, the researcher focused solely on MUET reading skills. The researcher addressed the challenges faced by MUET test-takers in the Reading component (800/3). These challenges may include difficulties in comprehending complex texts, identifying key information, and understanding the overall structure and purpose of the reading passages. By developing a chatbot tailored to enhance MUET reading skills, the researcher seek to provide students with targeted support and practice opportunities to improve their performance in this component.

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1.8.6 Reading Skills

According to Khalilova (2023) and Solikhah (2018), reading skills refer to a person's cognitive ability that enables them to engage with written material for the communication of information between the writer and the reader. Fu (2022) and Sumaira et al. (2022) highlighted the many kinds of reading skills, including skimming, scanning, extensive reading, and intensive reading. Skimming refers to the process of quickly reading for the core concept, while scanning is the process of quickly reading for a specific piece of information (Mambua, 2020). Meanwhile, extensive reading involves leisurely reading a long text by emphasizing its overall meaning (Sun, 2022), whereas intensive reading is the process of reading a short text quickly to extract specific information (Li & Zhang, 2022).

In this study, the researcher focuses on MUET reading skills. In the context of the MUET exam, reading skills encompass a range of abilities crucial for comprehending and analyzing written texts effectively. Skimming and scanning are essential for quickly locating specific information in a text, relevant for the MUET Reading component (800/3). Making conclusions, inferring, and summarizing are fundamental for interpreting information beyond its literal meaning. Referencing and differentiating facts from views require identifying the author's perspective and distinguishing between factual information and opinions. Reading critically to determine purpose, tone, and mood aids in understanding the text's underlying message. Anticipating outcomes involves predicting likely conclusions, while recognizing text structure helps understand how information is organized (Malaysian Examinations Council, 2019). Through focusing on these aspects, the researcher aims to enhance students' ability to engage with and analyze texts, improving their performance in the MUET reading test.

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1.9 Limitations of the Study

While the research provides insight on the use of chatbot to enhance MUET teaching and learning, it is crucial to acknowledge and address several limitations in the study design.

Firstly, the study's focus on university students, although providing valuable insights, presents a limitation in terms of generalizability. Given that MUET test-takers span across diverse educational backgrounds, including pre-universities, matriculations, vocational colleges, universities, and workplaces, the exclusivity to university students may limit the applicability of the findings to the broader MUET test-taker population. To enhance the external validity of the study, future research should replicate the investigation with participants from various educational levels and diverse age groups, ensuring a comprehensive understanding of the effectiveness of MUETBot across the entire spectrum of MUET candidates.

Secondly, the study's exclusive focus on reading skills within the MUET framework leaves other crucial skills, namely listening, speaking, and writing, unexplored. While the insights gained from the examination of reading skills are undoubtedly valuable, a comprehensive understanding of MUETBot's impact necessitates the inclusion of all four language skills. Future research endeavours should consider expanding the scope to encompass the holistic spectrum of MUET skills, providing a more nuanced and complete picture of the chatbot's efficacy in MUET preparation.

Lastly, it is essential to recognize that the accessibility of smartphones may introduce a potential bias in the study results. The assumption that participants have

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access to smartphones might overlook those students who do not own or have limited access to this technology. This bias could impact the representativeness of the study sample, potentially excluding a segment of the student population. Future studies should address this limitation by employing a more diverse range of participants or exploring alternative platforms to ensure a more inclusive understanding of the potential challenges and benefits associated with MUETBot across varying technological contexts. Acknowledging and addressing these limitations will contribute to a more robust and comprehensive interpretation of the study's findings and their implications for MUET teaching and learning.

1.10 Significance of the Study

This research significantly contributes to the field of intelligent tutoring systems, specifically in the context of language learning through chatbots. Novel findings and insights expand the existing knowledge base, providing educators, researchers, and curriculum developers with a deeper understanding of the integration of chatbots into language learning across educational levels. The outcomes of this study pave the way for future exploration and research endeavors in this evolving field.

Besides, this study's implications extend to policy makers and curriculum developers by offering valuable guidance on the integration of innovative technologies, such as chatbots, into educational frameworks. The research outcomes provide insights into the potential benefits of leveraging chatbots for language learning, assisting decision-makers in formulating policies that embrace technological advancements in education. Curriculum developers can draw inspiration from the findings to design dynamic and student-centric language learning materials.

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Next, educators and parents, as key stakeholders in shaping students' learning experiences, benefit from the study's insights into the effective use of chatbots for MUET learning. The findings guide educators in selecting appropriate technological tools and strategies, enhancing their ability to create engaging and effective learning environments. Parents, too, can leverage this guidance to make informed decisions about supplementary learning resources for their children, fostering a collaborative and supportive educational environment.

Apart from that, this study establishes a benchmark for the education technology industry, specifically in the development of chatbots tailored for MUET learning. The proposed MUETBot framework serves as a reference point, providing industry players with insights into effective instructional modules, practices, and assessment methods. This not only enhances the quality of educational technology products but also encourages innovation in content delivery, testing, and assessment, thereby raising the standards for MUET learning materials in the industry.

In summary, the significance of this study transcends the academic realm, influencing policy-making, curriculum development, educational practices, and industry standards.

1.11 Research Gaps

Since English is one of the essential soft skills outlined in the National Educational Blueprint, it is necessary to analyse the difficulties encountered by students and provide appropriate means and practical strategies to solve them. Toward this overarching goal, the researcher investigated the problems faced by MUET test takers

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and tries to solve them through a chatbot. This offers effective practices and improves the students' skills and techniques in answering MUET questions. With the practical advantages brought to students and teachers, chatbot serves as an essential platform for promising the future of learning MUET skills. Relevant gaps are identified and presented as follows:

First, few studies have been conducted on the potential of chatbots in facilitating the teaching and learning of MUET, and how chatbots could promote self-directed MUET learning among students. Chatbots have become a trend in education, but their application in language learning, specifically in Malaysia, is limited. Although chatbots such as Duolingo, Mondly, and Memrise have been widely applied in learning English, there are few chatbots designed to promote English language testing. Specifically, few researchers have ever studied into the effects of chatbots in teaching and learning for the preparation of MUET. Based on the search on Google Scholar and Scopus, with the keywords "chatbots in MUET learning," dated from 2019 to the present, there were only one in Google Scholar and none in Scopus, as shown in Table 1.1.

Table 1.1

Search Results of Chatbots in MUET Learning

Search engine	No. of articles
Google Scholar	1
Scopus	0

Next, this study aims to push forward the literature on chatbots. Numerous studies have been conducted to explore chatbot usage in various fields such as

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customer service, marketing, and business (Ngai et al., 2021; Kushwaha & Kar, 2021; Selamat & Windasari, 2021). They have often examined the development and examples of chatbots in these domains. Nevertheless, they have not always adequately explored the effectiveness of the chatbots developed and utilized. In this study, the researcher explores and leverages the adaptation capabilities of chatbots and aligns the chatbot evaluations with its implementation goals.

Besides, this study adds to the body of literature on research methodology. The researcher adopts a DDR design and adapts it to suit the needs and context of the study. The researcher loosely employs multiphase mixed methods (Creswell, 2014), combined with Richey and Klein's design and development framework. The researcher employs a variety of mixed techniques, including convergent or sequential approaches and quantitative or qualitative investigations, throughout the three-phase study. All of the methods used build on one another to accomplish a similar goal.

Hence, it is imperative to conduct this study to fill the existing research gap.

1.12 Overview of the Thesis

This first chapter of the research introduces the background of the study, statement of the problem, the purpose of the research, the rationale of the study, the objective of the study, research questions, research hypotheses, the conceptual framework of the study, the operational definitions of the terms used, the limitations of the study, the significance of the study, and the research gaps.

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The second chapter presents the literature review of the study. The first part explains the theoretical framework that forms the basis of the study. Meanwhile, the second part follows with the distinctive viewpoints of proponents in the field, with which critical evaluation has been attempted.

In Chapter 3, the research methodology and design are clearly explained. The mode of data collection, data analysis techniques, and validity of research techniques are highlighted in this chapter. The discussion encompasses the validity of data and sampling techniques used therein. The validity and reliability of various instruments used in the study are also discussed in this chapter.

In Chapter 4, the researcher focuses on the design and development process of the chatbot named MUETBot. The chapter starts by detailing the initial considerations, including a needs analysis and the expectations of expert panels regarding MUETBot's functionalities. It then delves into the design aspect, outlining the overall application structure, content design (comprising predefined and AI-assisted contents), and interaction design. The subsequent section discusses the development phase, covering technical considerations, the use of a large language model (specifically Dialogflow and OpenAI Initiative), the incorporation of ChatGPT, and the implementation of a custom server, along with its payload and query processing workflow. A development timeline is also provided, offering insights into the project's progression.

Moving on to Chapter 5, the researcher presents the findings of Phase 1, focusing on the needs analysis results obtained from the questionnaire. It then transitions to Phase 2, detailing the findings from the expert panels questionnaire and the subsequent evaluation. This evaluation includes results from the content validity

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assessed by experts, the user acceptance test (UAT) questionnaire, and the pre and post MUET reading tests, along with insights from student semi-structured interviews. The chapter concludes with a discussion section that interprets and contextualizes the findings, offering a comprehensive analysis of the data gathered throughout the study.

In Chapter 6, the researcher summarizes the study's key points. It then presents the conclusions drawn from the study, highlighting the implications for MUETBot's development and its potential impact on MUET students' learning outcomes. Recommendations for future studies are provided, suggesting areas for further research to enhance the chatbot's effectiveness and usability. The chapter ends with a concise summary that encapsulates the main findings and contributions of the research, providing a conclusive wrap-up to the study.

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