

The Interaction between Chatbot Pattern and learning style to Develop English Vocabulary Skills for intermediate School Students in the UAE

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Abstract

This research investigates the interaction between chatbot patterns (linguistic and voice) and learning styles (visual and auditory) in developing English vocabulary skills among intermediate school students in the UAE. A quasi-experimental design was employed with four groups of male and female Grade 8 students (N = 72), categorized based on their learning styles (visual vs. auditory) and chatbot interaction patterns (linguistic-based vs. voice-based). The participants were randomly assigned to the following groups: Visual-Linguistic, Visual-Voice, Auditory-Linguistic, and Auditory-Voice. To achieve the research objectives, several instruments were utilized, including a Learning Style Questionnaire (based on the VARK model), an English Vocabulary Skills Checklist, and a Vocabulary Knowledge Skills Test (pre- and post-tests). The chatbot was implemented through a web-based platform and integrated within Teams, the school's official Learning Management System (LMS). Quantitative results revealed significant differences in vocabulary acquisition between pre-test and post-test scores across all groups, with the greatest improvements observed in the Visual-Linguistic group, followed by the Auditory-Voice, Auditory-Linguistic, and Visual-Voice groups. The results also showed significant differences between the linguistic and voice groups in favor of the linguistic chatbot, with a high impact, while no significant differences were found between visual and auditory groups, with only a low impact. These findings underscore the effectiveness of chatbot-based interventions in enhancing English vocabulary skills, particularly when chatbot interaction types are aligned with students' learning styles. The research recommends integrating chatbot technologies tailored to students' learning styles into English language curricula to improve vocabulary acquisition and overall language proficiency.

Keywords: Chatbot patterns; learning styles; English vocabulary skills; intermediate school students; UAE.

1. Introduction

Education is the core of nation development. It is the key to many opportunities in life. For example, it illuminates a person's mind and helps them plan for the future. Finally, it gives students the knowledge and skills they need for work or to pursue higher education. The world has witnessed a great deal of interest in technology. there are Various technologies, such as interactive websites, artificial intelligence, synchronous chat, and virtual environments. Using technology in education helps educators and learners to achieve their goals faster and easier in high performance and results, it gives them the ability

to work in different environments in different times. one of these technologies which became part of life needs not only in education, but in all life fields.

Artificial intelligence (AI) has influenced how we engage in our everyday activities by designing and evaluating advanced applications and devices, called intelligent agents, which can perform various functions. A chatbot is an artificial intelligence program and a Human-computer Interaction (HCI) model (Khan, & Das, 2018).

Shevat (2017) noted that as education adapts to the realities of Industry 4.0, the thoughtful use of advanced digital technologies becomes increasingly important. For these, chatbots offer valuable support in language learning by creating interactive and accessible learning environments.

Kim (2016) explained that chatbots are designed to carry on conversations in a natural, human-like way, either through text or voice. This makes them especially useful for learners of foreign languages, as they offer opportunities to interact and practice in real-time. Jia & Chen (2009) also pointed out that chatbots can support English learning by helping students improve their reading and thinking skills. Overall, chatbots serve as practical tools for language learning and practice.

There are many perks of having a chatbot as a conversational partner when learning language, for example it could allow a student to practice their language skills anytime, it would not mind repeating the same material several times, it can incorporate both text, speech which might help a student with both their reading, writing and listening skills. (Roos, 2018). Learners are different in their learning and the way they prefer in learning or acquiring vocabulary.

Chatbots use artificial intelligence to process language, allowing them to understand human speech. Artificially intelligent chatbots are now helping students of English to improve their English skills. It is obvious that a lot of practice is required to learn a language. For students who learn English as a foreign language (EFL), it is difficult to find a native speaker to practice their English. However, intelligent chatbots, a tireless language tutor, can play that role. Acting as a native speaker, when students talk to them, they understand the students' words and provide a human-like response., EFL students practice their English in an effective way.

According to literature, there has been different learning styles and theories proposed by various authors, such as David Kolb, Peter Honey, Dun & Dun, Alan Mumford, and Anthony Gregorc. For them, the VARK learning inventory developed by Neil Fleming's is one of the most common and widely used learning style. The visual, aural, read/write and kinesthetic (VARK) learning inventory developed by Neil Fleming provides learners with a profile of their preferred modes of taking in information. The visual (V) learners mainly learn from reading information, the aural (A) learners prefer to hear information. (Noori, 2020)

2. Research problem

Although vocabulary is essential in language learning, many students, after years of studying the English language, are not able to speak fluently or communicate using the target language. They also lack proficiency in writing because of vocabulary and convention. Thus, there is a real need to adopt new techniques to encourage students to write, listen and speak

fluently and to overcome their speaking, reading, and writing difficulties making use of Chatbot in devices and applications. There is a great weakness in the English four skills of intermediate school students. This research aimed to develop an application based on chatbot pattern linguistic and voice to develop and Support language learning, specifically vocabulary learning. The researchers of the present research encountered this problem in different sources:

First, One of researchers As an English teacher in the UAE, noticed a lack in learning vocabulary skills. According to their results in ongoing assessments, assessments, and final exams, either internal or external, national or international, such as **(PISA)** exams, most students have difficulty with vocabulary skills. There is a gap between students' level and expected level, especially in reading and writing, because of vocabulary acquisition as the students have no interaction and enough time to practice vocabulary also, the teaching methods and teachers are not taking into consideration their learning styles. They lack an authentic experience of using this vocabulary in real life, enabling them to keep vocabulary longer and using chatbots that offer new teaching strategies, techniques, and new forms of activities. These technological tools give learners enough time and opportunities to do extra activities outside classrooms to enhance their communicative competence and ability to speak, read and write.

Second, a pilot study has been conducted on an eighth-grade class in intermediate school (United Private school-UAE). Students were asked to answer some simple questions about their likes and describe some pictures using vocabulary. Seventy-Nine students took part in the pilot study. The study showed that most students could not recognize or use vocabulary in reading, writing, and speaking skills. Only 38% succeeded in passing this simple vocabulary test. Their efficiency was inferior in all English skills. Many of the sample students came with no spelling or pronunciation at all. All pupils committed vocabulary mistakes related to context, synonyms, antonyms, and using words.

Furthermore, the researchers performed a pilot study based on a questionnaire to discuss English vocabulary difficulties and to try to find suitable solutions to overcome such challenges. The participants of the pilot study were (8) teachers who were randomly selected at UPS. The findings disclosed that students have difficulties with 65% spelling, 65% pronunciation, and 88% vocabulary acquisition, either active or passive. Eighty-three percent of the participants saw that students speak, write and read very little, whereas 88% admitted that students failed to learn in the same environment together. Moreover, 65% of the answers show that the students were making mistakes as they could not practice target vocabulary easily

Third, earlier studies showed clearly that learning English vocabulary can be difficult, especially for intermediate school students. Students often feel stressed by the number of words they need to learn. Languages are always growing, with new words constantly added. Oxford & Crookall (1990) explained that learning vocabulary isn't guided by clear grammar rules, which makes it even harder for students. Usually, students must practice and remember many new words throughout their studies. Several studies suggested that chatbots could help students learn vocabulary more easily. Researchers such as Kim (2016, 2018), Roos (2018), Shevat (2017), Khan and Das (2018), Mageira et al. (2022), Jia and Chen (2009), and Wang and Petrina (2013), all agreed that chatbot technology can support students in building vocabulary and overcoming difficulties.

The UAE leadership emphasizes the development and improvement of technical and vocational education, guided by their vision for 2030. As part of Education 2030, Shiohira and Kelly (2017) highlighted through UNESCO-UNEVOC the importance of understanding how

artificial intelligence (AI) impacts skill development. Additionally, the International Society for Technology in Education (ISTE, 2017) suggested that teachers should actively integrate technology into learning by creating activities and environments that match students' individual needs.

Many studies have also supported teaching approaches based on students' learning styles, including research by Pashler, McDaniel, Rohrer, and Bjork (2008), Abdul Rahman (2020), Noori (2020), Mayer (2003), and Ismail et al. (2014). Furthermore, and Mayer (2003) emphasized that curriculum planners should identify and consider students' preferred learning styles using models such as the VARK model to enhance effective learning.

The research aims to answer one major question: What is the effect of the interaction between chatbot patterns and learning styles on the development of English vocabulary skills for intermediate school students in the UAE?

This main question comprises the following sub-questions:

1. What are the essential English vocabulary skills that intermediate school students need to develop?
2. What is the proposed design of chatbot patterns (Linguistic-Voice) and Learning Styles (Visual-auditory) to develop English vocabulary skills for intermediate school student?
3. What is the effect of difference between chatbot pattern (linguistic and voice) on the development of English vocabulary skills for intermediate school students?
4. What is the effect of difference between learning style (Visual-Auditory) on the development of English vocabulary skills for intermediate school students?
5. What is the interaction effect between chatbot patterns (linguistic vs. voice-based) and learning styles (visual vs. auditory) on the development of English vocabulary skills for intermediate school students?

3. Literature review

In recent years, improvements in technology, especially artificial intelligence (AI), have greatly changed education. These new technologies have introduced fresh ways to teach and learn, strongly affecting how education happens today. Using AI and open-source (GNU) methods and tools has helped education improve, making it easier to meet different student needs. For over thirty years, researchers have studied how AI can be used in both regular classrooms and online learning environments. AI has changed learning by creating smart, personalized environments that adapt to each student's individual style. This has significantly improved the quality of education and made learning and teaching better for everyone involved.

3.1 AI in Education

In today's education landscape, the pressing need for improvements in teaching and learning is met with a growing interest in leveraging technology, particularly artificial intelligence (AI). Educators recognize AI's potential to support diverse student groups and enhance personalized learning experiences. The transformative impact of AI includes more effective, efficient, and affordable achievement of educational goals, addressing learning gaps exacerbated by the pandemic. AI tools, such as automated assistants, empower educators to provide personalized support in time-constrained scenarios. This technology facilitates the development of responsive, customized resources, creating interactive environments for

efficient educational outcomes (Walton Family Foundation, 2023). Consequently, AI plays a crucial role in creating interactive environments and wide-ranging resources to efficiently achieve educational objectives.

The evolution of AI in education is evident in the transition from traditional supercomputers to embedded systems, such as robots, designed to enhance learning experiences. These AI-embedded robots, particularly in early childhood education, assist students in routine tasks, showcasing adaptability to individual abilities and transforming the learning environment (Timms, 2016). Academic literature reviews, such as one by Snyder (2019), underscore the increasing application of AI in education, emphasizing the shift towards embedded systems like robots. This transformation has the potential to significantly impact the educational landscape. Beyond education, researchers in future wireless communications are exploring innovative channel coding techniques, such as root-photograph low-density parity-check codes, to approach outage limits and enhance wireless communication performance (Fang et al., 2019).

3.2 Chatbot

According to Walker and White (2013), chatbots, which are computer programs designed to engage in human-like conversations, provide foreign language learners with accessible opportunities to practice their target languages on various digital devices. As per Kim (2017), these chatbots are often perceived as novel and appealing by language learners, creating a comfortable and less intimidating environment for communication compared to interactions with human instructors, which can be particularly reassuring for those at lower language proficiency levels. In the words of Alemi, Meghdari, Ghazisaedy (2014), and Derakhshan, Tahery, Mirarab (2015), chatbots have demonstrated their potential to enhance students' focus, reduce negative emotions, and foster motivation, ultimately contributing to improved speaking proficiency in language learning. Nevertheless, despite their advantages, chatbots still have areas for improvement.

Hence, Chatbots, created for human-like conversations, offer language learners opportunities for practice via the web and digital devices. They hold the potential to improve focus, alleviate negative emotions, and boost motivation, thereby enhancing proficiency in speaking, reading, and listening skills in language learning.

Elmaadawy, Elnaggar, & Radwan (2025) describe chatbots as a contemporary and forward-looking educational approach. They emphasize the chatbots' ability to deliver educational content in an interactive and engaging manner, enhancing the learning experience. These chatbots enable teachers to send weekly lessons structured as "conversations" embedded within the chatbot, incorporating video elements. Each lesson is broken down into brief segments, followed by related questions and multiple-choice answers.

Deshpande et al. (2017) showcased that the creation of ALICE in the early 1980s marked a crucial development in Artificial Intelligence Markup Language (AIML). AIML, initially designed for defining pattern-matching rules, has become a cornerstone for various chatbot platforms and projects, playing a pivotal role in their operation. Over time, chatbot capabilities have advanced with the introduction of evolving technologies, particularly in artificial intelligence. These advancements involve increased knowledge in machine learning, data analytics, and, notably, natural language processing (NLP). NLP enables communication between humans and machines, as well as between machines, using natural human language

During the COVID-19 pandemic, the use of interactive chatbots in education has proven to be highly significant, offering several advantages such as improving the learning process, increasing student engagement, facilitating problem-solving in scientific subjects and online education, enabling fast decision-making, automating repetitive tasks like answering common student questions and managing emails, providing an interactive learning environment with timely alerts, assisting with data analysis for students' academic progress, and offering immediate communication and feedback to students (Thakor, Vasquez, et al., 2021). Several research findings have provided confirmatory evidence regarding the effectiveness of integrating chatbots within educational domains such as Roos (2018).

3.3 Chatbot in Language Learning and Teaching

Research studies in the context of language learning and teaching have explored the use of chatbots for educational purposes:

Heller et al. (2005) study introduced "Freudbot," benefiting psychology students in distance education with significant on-task behavior. Matsuura and Ishimura (2017) compared chatbots and humanoid robots in science lectures, revealing that chatbots, with visualization, improved student comprehension. These studies showcase chatbots' potential to enhance online and distance education experiences, from psychology to science lectures. Furthermore, Kim (2018) highlights significant improvements in reading and listening abilities for both groups. Notably, the experimental group interacting with the chatbot "Chabot" showed remarkable advancements in post-listening tests, elevating their proficiency from intermediate to advanced levels. This underscores chatbots' positive impact on enhancing students' language skills, particularly in listening comprehension. Research suggests that chatbots have the potential to improve teaching and learning experiences across various educational contexts, including online psychology education, science lectures, and language skills development. Their positive impact is evident in enhanced reading and listening proficiency, showcasing the versatility and effectiveness of interactive chatbots in meeting diverse educational needs.

3.4 Chatbot patterns

There are two main patterns of chatbots, Menu-based chatbots and AI-based bots. according to Varalakshmi. (2017) Rule-based chatbots offer users predefined options to select, guiding them to specific answers or information based on their choices. Typically used for simpler tasks like handling FAQs, they operate on a set of predefined rules.

There are various types of chatbots, each with distinct characteristics and applications. Menu/button-based chatbots rely on decision trees and are suitable for straightforward queries, while linguistic-based chatbots use predefined rules to answer anticipated questions. Keyword recognition-based chatbots employ

Chatbots can be categorized based on several parameters, including their knowledge domain, the services they provide, their goals, and the method they use to generate responses. A key distinction in chatbot classification is between open domain and closed domain chatbots, which depends on their knowledge base. Open domain chatbots are versatile, capable of engaging in conversations on a wide array of general topics. In contrast, closed domain chatbots are specialized, focusing on a specific knowledge domain, making them less suitable for questions outside their designated area. For instance, a restaurant booking chatbot excels in restaurant-related tasks but may struggle with unrelated inquiries. These classifications are vital for understanding the chatbot's knowledge and the specific functions they can perform.

A study by Jia and Chen (2009) found that chatbots enhance language learners' confidence, improve listening skills, and boost language proficiency. They are particularly useful for language learning as they promote interaction and enhance language skills. Various approaches can be employed to enhance chatbot knowledge, including starting with an empty database that automatically populates as the chatbot is used, structuring the database with pre-programmed questions and responses (Abdul-Kader & Woods, 2015). Additionally, chatbots can handle various tasks, from providing simple information to complex operations like booking tickets or sending money (ElNaggar & Habeeb, 2021).

3.5 English Vocabulary Skills

The pedagogy of vocabulary instruction within the context of English language teaching is a subject of extensive discourse. It encompasses not only the dissemination of word meanings but also the impartation of comprehensive insights into their origins, pronunciations, spellings, and usages (Diamond & Gutlohn, 2006). This study expounds on the conceptualization of vocabulary instruction, accentuating the criticality of holistic word comprehension extending beyond mere definitions.

The acquisition of vocabulary assumes a pivotal role in the realm of language acquisition, hinging on the intricate relationship between words and their utilization within textual contexts to elucidate word associations (Dalton & Grisham, 2011). An essential facet of vocabulary acquisition pertains to the assimilation of words within their contextual milieu. While learning vocabulary within context promotes superior retention as compared to isolated learning, it also necessitates learners' proficiency in deducing word meanings through contextual cues (Dalton & Grisham, 2011).

For educators, the adoption of effective techniques in vocabulary instruction is of paramount importance. An array of diverse methods facilitates teachers in effectively involving students in the learning process (Alqahtani, 2015). Successful vocabulary instruction encompasses the creation of a classroom environment conducive to student engagement and interest. The recognition of learners' distinct characteristics, particularly across various age groups, is indispensable for the tailoring of appropriate strategies and materials in language instruction (Alqahtani, 2015).

A spectrum of strategies exists for vocabulary instruction, including the elucidation of word etymologies, the employment of structural analysis techniques such as semantic mapping, guidance in discerning analogies, the integration of oral reading, and the advocacy for the use of dictionaries and computer-based tools (Mukoroli, 2011). Effective vocabulary instruction transcends a mere focus on definitions. Vocabulary should be intricately woven into conversational contexts, fostering profound engagement with language. Purposeful strategic dialogues within educational settings cultivate vocabulary development and augment students' language proficiency (Wasik & Lannone-Campbell, 2012).

3.6 The Vocabulary Learning Process

Learning vocabulary encompasses understanding word relationships and exposure in texts (Dalton & Grisham, 2011). English vocabulary is intricate, spanning form, meaning, use, and etymology (Nation & Meara, 2010). Effective vocabulary instruction extends beyond words, encompassing lexical phrases, vocabulary knowledge, and strategic learning and teaching.

Vocabulary learning is a multifaceted process that involves more than simply memorizing word definitions—it requires understanding word relationships, contextual usage, and morphological structures (Dalton & Grisham, 2011). English vocabulary is particularly complex, as it encompasses **form** (pronunciation, spelling, word parts), **meaning** (denotation, connotation, polysemy), **use** (grammatical functions, collocations, register), and **etymology** (word origins and historical development) (Nation & Meara, 2010). Effective vocabulary instruction should therefore go beyond isolated word lists and incorporate **lexical phrases** (fixed and semi-fixed expressions), **vocabulary depth** (knowledge of multiple word aspects), and **strategic learning approaches** (e.g., context-based inference, word-part analysis, and spaced repetition) (Schmitt, 2019).

3.7 Enhancing Vocabulary Learning Strategies

In her work, Pavicic (2003) provided insights into improving students' abilities to explore, retain, and effectively use vocabulary. She emphasized that teachers should create activities and tasks to help students expand their vocabulary and develop independent learning strategies (Pavicic, 2003). The context clue strategy for vocabulary learning involves deducing unfamiliar word meanings from surrounding text cues. Nation (1990) emphasizes leveraging existing English vocabulary and understanding connections between unfamiliar words and context. This method helps language learners make educated guesses in real-world applications. Rhoder and Huerster (2002) note its benefits for foreign language learners, emphasizing the importance of considering word frequency in different contexts. Successful implementation requires adequate vocabulary knowledge.

Roell (2010) classifies context clues into four types: definition or restatement, synonym, antonym /contrast, and example/explanation. Definition or restatement involves indicating the meaning within the sentence itself. Synonym uses similar words to explain unfamiliar terms, while antonym/contrast employs opposite meanings. Example/explanation provides instances to help infer meanings. Each type aids in understanding unfamiliar words within various contexts.

3.8 Learning styles

In the field of psychology, there has been extensive exploration of learning styles, resulting in the development of multiple models. One of the most renowned approaches for identifying and comprehending how individuals prefer to learn is the VARK model. Fleming (2006) defined learning style as the means by which a learner assimilates, arranges, and integrates knowledge and experiences within their cognitive framework. It also involves how they subsequently articulate this knowledge. The VARK questionnaire, formulated by Fleming, provides valuable insights into a learner's preferences for processing information, including their capacity to employ multiple learning styles simultaneously (Johnson, 2009).

So, understanding learning styles plays a vital role in enhancing the educational experience, as it helps tailor instruction to meet individual needs. The VARK model offers a practical framework for identifying how learners absorb and process information, emphasizing the importance of recognizing diverse preferences. By acknowledging these differences, educators can create more effective, inclusive, and engaging learning environments that support deeper comprehension and knowledge retention.

3.9 Understanding Students' Individual Differences

According to Sternberg (1994), understanding students' individual differences, including their learning style, is essential to ensure their acquisition and mastery of covered materials. Learning style, Sternberg explains, is not an inherent ability but is instead related to an individual's preferred way of utilizing their abilities. Different individuals exhibit diverse learning preferences, with some excelling in reading and writing, others in visual learning through pictures and graphs, and some in auditory learning. These variations are classified into four primary learning styles: visual, auditory, reading/writing, and kinesthetic (VARK), each with its distinct features. Visual learners thrive when using maps, charts, and diagrams, while auditory learners prefer listening to tapes or lectures. Those who learn best by reading and writing are referred to as reading/writing learners, and kinesthetic learners prefer a hands-on approach to learning.

3.10 Learning styles models

Several models have been developed to address the concept of learning styles. One such model is **McCarthy's** Formative model, which is based on David Kolb's theory and focuses on how individuals acquire knowledge and approach new situations through emotional or cognitive processes. McCarthy's model contributes to the fields of behavioral and experiential learning, emphasizing individual differences, professional development, and executive education. This model aligns the learning cycle with distinct learning styles (Dayer, 2005).

Another model is The **Dunn and Dunn** model addresses variables influencing student performance and emphasizes the importance of matching teaching methods with individual learning styles to enhance motivation and performance. It highlights the need for adaptable teaching approaches, considering factors like educational planning, group dynamics, classroom design, teaching techniques, and assessment methods (Dann and Dann, 1993).

Additionally, the **Kolb** Learning Style Inventory categorizes learning styles based on an individual's orientation and motivations. It identifies three styles: Diverging, Assimilating, and Converging (Kolb, 1984).

Furthermore, **Silverman's** Learning Styles Inventory defines learning styles as a combination of cognitive, emotional, and psychological behaviors. This model includes four dual-footed styles: Practical-Reflective, Sensing-Intuitive, Verbal-Visual, and Sequential-Global (Silverman, 1988). These models provide valuable insights into the diversity of learning styles and the importance of aligning teaching methods with individual preferences.

3.11 VARK model

There have been various theories and models proposed to describe how individuals prefer to learn. These theories come with their own respective references and have made significant contributions to understanding learning styles. One of the well-known models is the VARK model, introduced by Neil Fleming in 2001. This model categorizes learning preferences into four styles: visual, auditory, reading/writing, and kinesthetic (Fleming & Mills, 2011).

Fleming (1992) suggests that a person's learning style is their preferred approach to acquiring, processing, and organizing information, reflecting their personal preferences in learning methods. Keefe (1987) defines learning style as a combination of cognitive, emotional, and physiological traits that indicate how a learner perceives, interacts with, and responds to

their learning environment. Recognizing and understanding these learning styles can help educators better tailor their instructional methods and reduce student frustration (Keefe, 1987). This understanding is essential for curriculum planners who seek to create curricula that cater to students' unique needs, ultimately enhancing academic performance (Fleming & Mills, 2011).

4. Method:

4.1 Participants

The researchers randomly selected the sample from eighth-grade students at intermediate schools in the UAE. A total of 74 students were chosen to participate in the study, and they were categorized into groups based on their learning styles. The students' preferred learning styles (visual or auditory) were identified using a Learning Styles Questionnaire.

The sample was then divided into four groups:

Group	Students	Description
Visual + Linguistic	18	Text-based chatbots for visual learners
Visual + Voice	18	Audio-based chatbots for visual learners
Auditory + Linguistic	18	Text-based chatbots for auditory learners
Auditory + Voice	18	Audio-based chatbots for auditory learners

Table 1

Description of Research Groups and Their Learning Modalities

The participants were pre-tested using an English vocabulary test to measure their initial knowledge of vocabulary skills. Each group then studied the same vocabulary content from the second unit of their English curriculum, titled "Humans and Their Place in the Universe," during the second term of the 2025 academic year (January to April). The students practiced vocabulary tasks using a learning style-based chatbot integrated into Microsoft Teams, which provided adaptive activities tailored to their specific learning styles.

At the end of the intervention, the sample was post-tested using the same English vocabulary test to evaluate improvements in their vocabulary skills. Finally, the researchers analyzed the results, discussed the findings, and presented recommendations based on the outcomes.

4.2 Research Instruments

The research instruments consisted of: Learning Style Questionnaire (Visual vs. Auditory) Based on the VARK model, English Vocabulary Skills Checklist, Vocabulary Skills Test, Chatbot Patterns (Linguistic-Voice).

4.3 Procedures of testing

A) Pre-Application Phase:

The learning style questionnaire was administered to the students via the chatbot. The questionnaire items were presented to the students, and each response was scored. Upon completion of the questionnaire, the chatbot, based on a flowchart, determined each student's preferred learning style (auditory or visual) and stored this data in their profiles. This was conducted with a total of 78 male and female students. Following this, the participants were divided into two groups: Group (1) with an auditory learning style (36 students), and Group (2) with a visual learning style (36 students). Only six students in the sample preferred the kinesthetic learning style. As a result, the third group—related to kinesthetic learners—was excluded from the study due to the limited number of students who preferred this style in the current research. Subsequently, the students in each category were evenly divided according to the chatbot mode: half were assigned to the Linguistic chatbot and the other half to the Voice chatbot, resulting in four groups for the application of the study. The English vocabulary skills test was administered as a pre-test to the research sample after the groups were assigned, in order to verify the equivalence of the research groups.

B) Equivalence of research groups

In order to verify the equivalence of the experimental groups in the pre application of English Vocabulary skills, the researchers conducted One Way ANOVA test on the study groups, and the results were represented in the following table:

	Sum of Squares	df	Mean Square	F	Sig.	Significance
Between Groups	5.708	3	1.903	.718	.545	Non-Significant
Within Groups	180.167	68	2.650			
Total	185.875	71				

Table (2)

One Way ANOVA test for the difference between the experimental research groups in the pre-application of the English vocabulary skills test

It is clear from the previous table that there are no statistically significant differences between the mean scores of English Vocabulary test of the four study groups, and thus the equivalence of groups in the English vocabulary skills is evident.

C) Applying Content

Uploaded learning materials and assessments aligned with the researches' objectives to the chatbot platform. Designed activities to match students' learning styles, ensuring comprehensive vocabulary skill development.

D) Interactive Learning Strategies

Fostered interactivity through chatbot conversations, quizzes, and real-time feedback. Incorporated gamification elements such as points, badges, and leaderboards to sustain student motivation and engagement.

4.4 Monitoring and Evaluation

A) Monitoring Usage

Regularly tracked students' engagement through the chatbot dashboard, capturing data on login frequency, session duration, and activity completion rates. Collected insights from analytics to identify areas for improvement.

B) Feedback and Observations

Documented student progress and noted challenges encountered during the implementation. Solicited feedback from parents and teachers to address any technical or instructional concerns.

C) Assessing Satisfaction

Conducted satisfaction surveys embedded within the chatbot to gauge student engagement and usability. Reviewed analytics to identify frequently used features and ensure alignment with learning goals.

4.5 Goals and Outcomes

A) Chatbot Usage Patterns

Identified trends such as peak interaction times and preferred activities to refine the learning experience. Ensured consistent and meaningful use of the chatbot for maximum vocabulary skill development.

B) Promoting Interactivity

Designed scenario-based exercises and collaborative tasks to encourage active participation. Supported students in exploring new vocabulary contexts and practicing real-world applications.

4.6 Post-Implementation Review

A) Follow-Up and Feedback

Conducted follow-up sessions to collect qualitative feedback from students and teachers. Administered post-tests to evaluate vocabulary improvement compared to pre-test results.

5. Research Findings:

To answer the first research question which states: "What are the essential English vocabulary skills that intermediate school students need to develop?"

The researchers reviewed previous studies and literature in the field of English vocabulary skills, building a list of English vocabulary skills, and presented the list of skills to a group of experts and arbitrators in the field of English, and made the amendments approved by the arbitrators, and reached to 4 main skills divided into 26 sub-skills.

To answer the second research question which states: "What is the proposed design of chatbot patterns (Linguistic-Voice) and Learning Styles (Visual-auditory) to develop English vocabulary skills for intermediate school student?"

The researchers built a chatbot pattern (Linguistic – Voice) for intermediate school students determining their learning style (Visual – Auditory), and developed the application and validated it, after that applied the application on students for developing English vocabulary skills, this based on ADDIE Design Model.

To answer questions from the third to the fifth, which states:

1. What is the effect of difference between chatbot pattern (linguistic and voice) on the development of English vocabulary skills for intermediate school students?
2. What is the effect of difference between learning style (Visual-Auditory) on the development of English vocabulary skills for intermediate school students?
3. What is the interaction effect between chatbot patterns (Linguistic-Voice) and learning styles (Visual-Auditory) on the development of English vocabulary skills for intermediate school students?

The researchers verified the validity of the research hypotheses related to the effect of the interaction between chatbot patterns (Linguistic-Voice) and learning styles (Visual-Auditory) to develop English vocabulary skills for intermediate school students, which are the hypotheses numbers (1, 2, 3), which stated:

1. There is no statistically significant difference at the level of (0.05) between mean scores of English vocabulary skills test scores between intermediate school students using different chatbot patterns (linguistic vs. Voice).
2. There is no statistically significant difference at the level of (0.05) between mean scores of English vocabulary skills test scores between intermediate school students with different learning style (Visual-Auditory).
3. There is a statistically significant interaction at the level of (0.05) between chatbot patterns (linguistic vs. Voice) and learning styles (Visual vs. Auditory) in developing English vocabulary skills for intermediate school students in the UAE.

The following are the results of the statistical analysis of the effect of interaction between chatbot patterns (linguistic vs. Voice) and learning styles (Visual vs. Auditory) to develop English vocabulary skills, table (3) shows the mean scores of the different groups in the post application of the English vocabulary test, in addition to the standard deviation for each group.

Variable		chatbot patterns		Total
		linguistic	Voice	
learning style	Visual	Mean= 36.00 St.dv.= 1.782 N= 18	Mean= 28.33 St.dv.= .970 N= 18	Mean= 32.17 St.dv.= 4.137 N= 36
	Auditory	Mean= 30.89 St.dv.= .832 N= 18	Mean= 32.56 St.dv.= 1.381 N= 18	Mean= 31.72 St.dv.= 1.406 N= 36
Total		Mean= 33.44 St.dv.= 2.932 N= 36	Mean= 30.44 St.dv.= 2.443 N= 36	Mean= 31.94 St.dv.= 3.076 N= 72

Table (3) Mean scores and Standard Deviation of primary students in post application of English Vocabulary skills test (Maxmum Grade = 40)

It is evident from Table (3) that:

- The mean score of linguistic group is higher than The mean score of Voice group in English Vocabulary skills test.
- The mean score of Visual group is higher than The mean score of Auditory group in English Vocabulary skills test.

Table (4) contains the data necessary to know the significance of each of:

- The difference between the mean scores of intermediate school students in the group of linguistic chatbot pattern, and the mean scores group of voice chatbot pattern.
- The difference between the mean scores of intermediate school students in the group of Visual learning style and the group of Auditory learning style.
- The interaction between chatbot patterns (linguistic vs. Voice) and learning styles (Visual vs. Auditory) to develop English vocabulary skills for intermediate stages students.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta ²	Sig
chatbot patterns	162.000	1	162.000	96.444	.000	4.586	high
learning styles	3.556	1	3.556	2.117	.150	0.374	low
chatbot patterns * learning styles	392.000	1	392.000	233.370	.000	13.269	high
Error	114.222	68	1.680				
Total	74144.000	72					
Corrected Total	671.778	71					

Table (4)

Two-way analysis of variance of the impact of interaction between chatbot patterns (linguistic vs. Voice) and learning styles (Visual vs. Auditory) on English vocabulary skills test

From Table (4), it is evident that the value of “F” is 96.444 for the chatbot pattern variable, which is statistically significant at the 0.05 level. The significance value is 0.000, which is smaller than 0.05, indicating a statistically significant difference at the 0.05 level between the mean scores of intermediate-stage students using different chatbot patterns (linguistic vs. voice) in the post-English vocabulary skills test. Additionally, the Eta² value is 4.586, demonstrating a high effect size, further confirming the strong impact of chatbot patterns on vocabulary acquisition. Therefore, the first hypothesis is rejected.

From Table (4), it is evident that the value of “F” is 2.117 for the learning style variable, which is statistically not significant at the 0.05 level. The significance value is 0.150, which is greater than 0.05, indicating a statistically non significant difference at the 0.05 level between the mean scores of English vocabulary skills test scores for intermediate school students with different learning styles (Visual-Auditory). Additionally, the Eta² value is 0.374, demonstrating a low effect size, further confirming the weak impact of learning style differences on vocabulary acquisition. Therefore, the second hypothesis is accepted.

From Table (4), it is evident that the value of "F" is 233.370 for the interaction between chatbot patterns (linguistic vs. voice) and learning styles (visual vs. auditory) in developing English vocabulary skills for intermediate school students in the UAE. This interaction effect is statistically significant at the 0.05 level, with a significance value of 0.001, which is smaller than 0.05. This indicates a statistically significant difference at the 0.05 level between the mean scores of intermediate-stage students in the post-English vocabulary skills test for the four experimental groups due to the effect of the interaction between chatbot patterns and learning styles. Additionally, the Eta² value is 13.269, demonstrating a high effect size, confirming the meaningful impact of this interaction. Therefore, the third hypothesis is rejected.

To determine the direction of differences between groups and in favor of any of the groups, the "Scheffe test" was used for dimensional comparison. The following table shows the results:

Groups	Mean	Linguistic-Visual	Linguistic-auditory	Voice-Visual	Voice-auditory
Linguistic-Visual	36.00		**5.11	**7.67	*3.44
Linguistic-auditory	30.89			*2.56	-1.67
Voice-Visual	28.33				** -4.23
Voice-auditory	32.56				

(*)level 0.05 (**)level 0.01

Table (5)

The significance of the differences for the interactions between the mean scores of the four groups in English Vocabulary skills test

The results presented in Table (5) indicate that The mean scores of Visual learning style students who studied through Linguistic chatbot pattern occupies the first highest grade group, then in the second highest group the auditory learning style students who studied through voice chatbot pattern, then in the third highest group the auditory learning style students who studied through Linguistic chatbot pattern, then in the fourth and last highest group the Visual learning style students who studied through Voice chatbot pattern.

The findings highlighting the greater effect of linguistic chatbot patterns compared to voice chatbot patterns in enhancing English vocabulary skills for intermediate school students stem from several interrelated reasons. Linguistic chatbots, which operate through text-based communication, encourage students to read and write, thereby strengthening vocabulary acquisition, spelling, and grammar by providing visual exposure to words. This visual reinforcement aids in memory retention and helps students grasp word meanings and usage more effectively. Furthermore, text-based interactions support self-paced learning, allowing students to absorb information at their own speed, which is especially advantageous for

vocabulary building. The emphasis on accuracy and precision in written responses prompts students to focus on proper word usage and sentence construction, deepening their understanding. Linguistic chatbots also deliver written feedback and corrections that students can revisit and analyze, unlike voice chatbots, which provide auditory feedback that is less easily retained. Additionally, text-based chatbots frequently introduce vocabulary within contextualized sentences or scenarios, enabling students to see how words function in various contexts—a key element of vocabulary learning. Lastly, text-based interactions may lessen cognitive load for intermediate school students, as they permit more gradual information processing compared to the immediate demands of listening and speaking. Together, these benefits make linguistic chatbot patterns a more effective tool for developing English vocabulary skills than voice-based methods. Also, many students prefer using text chatbots over voice chatbots for several reasons. One reason relates to privacy and confidentiality. They feel that using text chat offers a higher level of privacy, as they can save and review the text at any time. Additionally, they view text chat as more available and convenient; they can communicate with the bot at any time without having to worry about external factors such as noise or privacy. Some consider text chat to offer a higher level of accuracy and clarity in communication, as text chatbots enable information to be presented in an organized and easy-to-understand manner, without the risk of confusion or misunderstanding. Students can also keep records of their text chat sessions. This result agreed with the results of the study of Hussein (2024), and the results of the study differ from the study of Elmaadaway et al., (2025) which confirmed the superiority of voice chatbots over text chatbots in teaching the English language.

The findings revealing no significant differences between visual and auditory learners when using chatbots to enhance English vocabulary skills can be explained by the flexible and multimodal design of chatbot interactions, which effectively address the unique needs of both learning styles. Visual learners benefit from text-based chatbots that provide written content, such as definitions, contextual examples, and written feedback, allowing them to process information through reading and visual input, which aligns with their preference for written language and supports vocabulary retention through repeated exposure. Auditory learners, on the other hand, excel with voice-based chatbots that deliver spoken language, pronunciation examples, and auditory feedback, enabling them to learn through listening, while features like repetition, adjustable speech speeds, and replayable audio segments help them retain and internalize vocabulary. Many chatbots also integrate multimodal features, such as pairing spoken words with on-screen text or visual aids, ensuring that both visual and auditory learners can reinforce their understanding through multiple sensory channels. Additionally, chatbots support self-paced learning, allowing visual learners to read at their own speed and auditory learners to replay or adjust audio to match their comprehension needs, reducing cognitive strain and promoting engagement. The interactive nature of chatbots, including quizzes, games, and conversational practice, further bridges the gap between learning styles by providing dynamic and engaging methods to reinforce vocabulary. By combining visual and auditory elements, offering self-paced flexibility, and incorporating interactive features, chatbots create an inclusive learning environment that leverages the strengths of both visual and auditory learners, resulting in comparable vocabulary development outcomes for both groups. Thus, Chatbots accommodate both visual and auditory learning styles by providing text-based content for visual learners and audio-based content for auditory learners, while integrating multiple modalities such as text, images, and sound. They also support self-paced and interactive learning, allowing each student to learn in a way that suits them, leading to

equal outcomes in vocabulary development. This result agreed with the results of the study of: Gilakjani (2012), Zhang and Huang (2024).

Regarding The interactivity between chatbot patterns (linguistic and voice) and learning styles (visual and auditory) significantly influences the effectiveness of learning English vocabulary for intermediate school students, as it determines how well the instructional method aligns with individual cognitive preferences. Linguistic chatbots, which operate through text-based interactions, are particularly effective for visual learners because they provide written vocabulary, contextualized sentences, and visual feedback, allowing students to process information at their own pace and reinforce learning through repeated exposure to written language. This method supports the cognitive strengths of visual learners, who excel at organizing and retaining information presented in a visual format. In contrast, voice chatbots, which rely on auditory input and output, are better suited for auditory learners, as they enable students to engage with spoken language, practice pronunciation, and develop listening skills in real-time. However, the transient nature of auditory input can make it more challenging for auditory learners to retain and review vocabulary compared to the permanent and revisable nature of written text provided by linguistic chatbots. Additionally, linguistic chatbots often offer broader advantages, such as self-paced learning, visual reinforcement, and detailed written feedback, which are critical for vocabulary acquisition and cater to a wider range of learners. This interplay demonstrates that while both chatbot patterns have value, linguistic chatbots tend to be more universally effective due to their ability to support multiple learning styles and provide a more structured and retainable learning experience.

The influence of learning theories on the use of chatbot patterns (linguistic and voice) for enhancing English vocabulary skills for intermediate school students can be examined through various theoretical perspectives. Cognitive Theory (Sweller, 1988) suggests that linguistic chatbots help reduce cognitive load by enabling students to process written text at their own speed, improving memory retention and vocabulary learning, while voice chatbots might heighten cognitive strain due to the immediate need for auditory processing. Constructivist Theory (Piaget, 1954; Vygotsky, 1978) focuses on the idea that learners build knowledge through interaction, with linguistic chatbots allowing students to actively engage with vocabulary in written contexts, whereas voice chatbots, which prioritize auditory input, may restrict this constructive process. Behaviorism (Skinner, 1957) highlights the role of reinforcement in learning, with linguistic chatbots offering written feedback and voice chatbots providing auditory responses, though written feedback tends to be more easily retained. Social Learning Theory (Bandura, 1977) posits that learning happens through observation and imitation, with voice chatbots aiding in pronunciation and conversational practice, while linguistic chatbots enhance written communication and vocabulary application. Connectivism (Siemens, 2005) emphasizes the significance of networked learning, where linguistic chatbots help students link vocabulary to digital text-based materials, and voice chatbots incorporate auditory learning into digital platforms. Lastly, Active Learning Theory (Bonwell & Eison, 1991) stresses the importance of student engagement, with linguistic chatbots encouraging active reading and writing, and voice chatbots promoting active listening and speaking. Collectively, these theories illustrate that both chatbot patterns have value, but linguistic chatbots often prove more effective for vocabulary development due to their alignment with cognitive and constructivist principles, as well as their capacity to support visual and self-paced learning experiences.

Also, The influence of learning theories on English vocabulary acquisition for visual and auditory learners can be explored through multiple theoretical perspectives. Cognitive Theory (Sweller, 1988) indicates that visual learners gain advantages from linguistic chatbots, as text-based interactions lower cognitive load, whereas auditory learners may face difficulties with the immediate processing required by voice chatbots. Constructivist Theory (Piaget, 1954; Vygotsky, 1978) suggests that visual learners build knowledge more effectively through written vocabulary provided by linguistic chatbots, while auditory learners may struggle to construct meaning from fleeting spoken language. Behaviorism (Skinner, 1957) highlights the importance of reinforcement, with linguistic chatbots offering written feedback that is easier for visual learners to retain, compared to the less durable auditory feedback from voice chatbots. Social Learning Theory (Bandura, 1977) reveals that visual learners benefit from observing and practicing written vocabulary, while auditory learners rely on imitating pronunciation, which may not be as effective for long-term retention. Connectivism (Siemens, 2005) emphasizes that visual learners can more effectively link vocabulary to digital text-based resources, whereas auditory learners may find it challenging to integrate spoken input with other learning materials. Lastly, Active Learning Theory (Bonwell & Eison, 1991) shows that linguistic chatbots promote active reading and writing for visual learners, while voice chatbots focus on active listening and speaking, which may not be as impactful for vocabulary development. Collectively, these theories clarify why visual learners often achieve better outcomes than auditory learners in vocabulary acquisition when using chatbots.

6. Research recommendations

Considering the results, the research recommends:

1. Focus on leveraging advanced technologies, particularly chatbot patterns, to enhance learning experiences for intermediate school students.
2. Carry out research to analyze and compare the effectiveness of text-based and voice-based chatbots in improving vocabulary skills for visual and auditory learners.
3. Design chatbots capable of adapting to individual learning preferences by incorporating both text and voice functionalities for a tailored learning experience.
4. Investigate the potential of integrating text and voice-based interactions within chatbots to create an inclusive and balanced learning environment suitable for all students.
5. Assess the impact of text-based and voice-based chatbots on cognitive load and long-term retention rates for students with visual and auditory learning preferences.
6. Examine how gamification and interactive elements in chatbots can enhance student motivation and engagement across different learning styles.
7. Equip educators with the necessary training to effectively implement chatbots in classrooms, ensuring they can address the diverse learning needs of students.

7. Suggestions for further research

Considering the research results, the researchers proposes to conduct the following studies and research

1. Investigate the long-term effects of text-based and voice-based chatbots on vocabulary retention and skill development for visual and auditory learners.

2. Develop and test adaptive chatbot systems that customize interactions based on individual learning styles (visual or auditory).
3. Explore the effectiveness of combining text-based and voice-based features in a single chatbot to support both learning styles simultaneously.
4. Study how text-based and voice-based chatbots influence cognitive load and learning efficiency for visual and auditory learners.
5. Compare the impact of written feedback (text-based) versus auditory feedback (voice-based) on vocabulary acquisition and retention.
6. Examine how linguistic differences affect the effectiveness of text-based and voice-based chatbots for diverse student populations.

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