THE USE OF AN INTERACTIVE CHATBOT IN GRAMMAR LEARNING

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ABSTRACT

The current study attempted to measure the impact of using an interactive WhatsApp bot designed using Python language programming in grammar learning. To this end, sixty Omani pre-intermediate English proficiency learners were the sample population of this study to act as a control and experimental group, with an equal number of students in each group. A pretest was conducted to measure students' grammatical knowledge and ensure the homogeneity of the students before treatment. Although both groups received in-class instructions on using grammar, the experimental group received treatment that used an interactive WhatsApp bot as an extra facilitator to obtain materials outside of the classroom. After the treatment period, a posttest was conducted to compare the results of the two groups. Three weeks later, a delayed post-test was conducted to check the students' retention of the grammatical structure. The study's findings showed that both groups progressed in the posttest, which could result from teachers` instructions; however, the experimental group showed statistically significant progress in the posttest compared to the control group. The results of this study could provide better opportunities for teachers, students, and institutions to work efficiently and accurately in an academic environment.

Keywords: *interactive chatbot, grammar*

INTRODUCTION

In recent decades, there has been a surge in the utilization of computer-assisted language learning and related technologies, such as websites, simulations, and online conversations, to assist individuals in learning a new language. An increasing number of studies have been conducted in the era of the Fourth Industrial Revolution to determine whether AI chatbots are effective in teaching and learning English. The expansion of Artificial Intelligence (AI) applications in education is rapid (Ng & Chua, 2023; Roos, 2018). A chatbot application enables students to exchange information via voice or text (Kerly et al., 2006). There is widespread consensus that chatbots, the most recent ingenious innovation, offer valuable solutions to numerous challenges associated with implementing technology to support educational endeavors. The use of chatbots to facilitate an interactive learning experience, including one-on-one conversations between instructors and learners, demonstrates this. Additionally, it is suggested that software serves as a valuable tool for enhancing the individual learning abilities of students, and is an ideal tool for facilitating student participation in learning activities at their tempo, free from the burden of waiting for the instructor or their peers. Chatbots enable students' educational endeavors and derive significant benefits from the system within a classroom setting (Colace et al., 2018).

Currently, chatbots are experiencing a surge in prominence to the extent that they are inevitably establishing themselves as a dominant force in regulating human-digital interactions (Dale, 2016). The presence of online chatbots in most messaging applications and on numerous information-focused websites, including academic

institutions, libraries, and museums, indicates how humans learn new languages and transform them in multiple ways (Fryer et al., 2020). Chatbots have progressively become an all-encompassing medium for disseminating advanced knowledge because of their acknowledged efficacy and strategic nature as a communication medium (Kumar et al., 2021; Vázquez-Cano et al., 2021). The capabilities of chatbots, which are unattainable through in-person communication, enhance the visibility of the system in the contemporary teaching profession. This is because it offers a secure and private setting in which learners can acquire practical knowledge to rectify their errors, even when they commit mistakes (Winkler & Soellner, 2018).

Chatbots are particularly regarded as effective English education instruments because they provide limited-opportunity EFL (English as a Foreign Language) students with a real-world setting that enables them to speak English continuously without time or location limitations. Additionally, chatbots boost confidence, motivation, and interest in English (Shevat, 2017; Shin, 2019). The development of an AI chatbot requires expertise in information technology and computing; therefore, its implementation in language instruction is not widespread (Nghi et al., 2019).

A chatbot system is widely recognized as a prominent AI technology that facilitates educational tasks (Okonkwo & Ade-Ibijola, 2020). In education, chatbots are regarded as potentially beneficial technology for facilitating learning (Clarizia et al., 2018). During the current Fourth Industrial Revolution (4IR) period, educators can deliver instruction via online platforms or in-person classrooms by utilizing various technological tools, including chatbot systems (Mendoza et al., 2020).

Cunningham-Nelson et al. (2019) stated that implementing chatbot technology in education is one of the most significant strategies for fostering and advancing a more individualized learning experience. Liu et al. (2019) and Yin et al. (2021) believe that knowing more about the role and functions of chatbots in learning environments necessitates conducting more research studies that mainly focus on chatbots. To this end, the current study attempted to investigate the following question to measure the impact of developing interactive chatbots on the grammatical improvements of Omani EFL learners.

The following research question will be thoroughly analyzed in this study:

> Does using an interactive WhatsApp bot improve Omani intermediate EFL learners' grammatical knowledge in an English language learning environment?

LITERATURE REVIEW

Chatbots and Grammar

Hidayati and Machmuda (2022) tried to determine whether tenth-grade students' grammatical proficiency in report texts could be improved using WhatsApp groups. A total of seventy-one pupils were included in the study. Utilizing a pretest, questionnaire, and posttest, the experimental group received grammar instructions via WhatsApp. Grammar grades of the experimental group improved significantly more than those of the control group from pre- to post-test. The WhatsApp group had a statistically significant positive impact on grammar proficiency, as determined by an independent sample t-test.

Ahn (2022) studied the impact of deploying a chatbot to help Korean EFL college students become more proficient in grammar, particularly in prepositions and articles. Forty-six pupils participated in the study. They were split into two groups: a control group and an experimental group that communicated with a Dialogflow chatbot. The experimental group had six conversation sessions with the chatbot for six weeks, during which frequent article and prepositional mistakes were corrected. The groups were contrasted using a pretest and posttest to examine the frequency of errors in the writing samples. Following their conversation with the chatbot, the experimental group's omission mistakes for prepositions and articles decreased significantly, whereas the control group exhibited no change in either area. The other mistake categories were mostly unaffected by chatbots. The chatbot may be able to reduce certain grammatical mistakes, but better feedback is still required to increase student accuracy and interest.

Kharis et al. (2022) aimed to create and assess a chatbot known as Gramabot, which would aid in the interactive study of German grammar. The chatbot was programmed to assist with grammar topics at the introductory level by employing a string matching technique. The participants were

thirty-six Indonesian college students studying Germany. One week after utilizing the chatbot, the students responded to an online questionnaire regarding their experience. Most students were not accustomed to using chatbots for learning purposes before using Gramabot; however, they found it useful for comprehending fundamental grammatical concepts, such as tenses and verbs. After the implementation, the chatbot reduced omission errors in writing. Gramabot did not substantially improve other categories of grammatical mistakes, and the program required additional conversational skills to maintain student interest. In general, this research illustrates the capacity of chatbots to facilitate interactive grammar learning. However, subsequent iterations should prioritize enhancements to conversational and feedback functionalities.

Kim (2019) explored how Korean college students' English grammar skills improved by utilizing chatbots powered by artificial intelligence. Seventy participants were divided into experimental and control groups. The control group engaged in discussions with peer companions for sixteen weeks, while the experimental group participated in ten communication sessions with Replica, a chatbot. Grammar changes were assessed by administering a pretest and posttest to both groups before and after the intervention. The TEPS grammar exam was used as an evaluation instrument. The improvements in the two groups were compared using an independent t-test. According to the findings, both groups improved their grammatical abilities considerably, with the experimental group exhibiting considerably more progress than the control group did.

Kwon et al. (2015) examined GenieTutor, a computer-assisted method for learning second languages that relies on assessments of grammar and semantic accuracy. GenieTutor used a tutoring module to conduct role-play conversations with English-language learners on various themes. This module uses a language model and domain knowledge to semantically analyze and categorize learners' replies. Additionally, it uses a hybrid corrected error system that combines rule-based, artificial intelligence, n-gram, and distance editing techniques to identify grammatical problems. More than fifty Korean students used GenieTutor for two months, producing 3,024 utterances for semantic evaluation and 858 sentences for grammatical fault repair assessment. A 97.5% success rate was attained in semantic categorization, 87.8% in feedback categorization, 79.2% accuracy, and 60.9% recall in grammar correction experiments that tested the assessment components. This research attested to GenieTutor's capacity to provide automatic feedback on students' answers.

WhatsApp and Language Learning Environment

Many studies have substantiated the potential efficacy of WhatsApp in educational environments and language acquisition (e.g., Aburezeq & Ishtaiwa, 2013; Ali & Bin-Hady, 2019; Almekhlafy & Alzubi, 2016; Alshammari et al., 2017). Research has demonstrated that WhatsApp significantly improves English language learners' performance and proficiency, while reducing anxiety (Ali & Bin-Hady, 2019).

Additionally, Alshammari et al. (2017) discovered that WhatsApp facilitates the formation of learning communities, repositions instructors as facilitators, and promotes autonomous peer learning. Conversely, the rise of WhatsApp coincided with an expansion of ad hoc instantaneous learning, which necessitates stringent regulations. These results validate the assertions of Kartal (2019), who suggested that instantaneous manipulation through MALL programs (such as WhatsApp) could benefit the development of writing and vocabulary abilities. According to Kartal (2019), WhatsApp allows learners to study languages outside of the classroom with greater flexibility and autonomy, which may increase their motivation.

Syarif and Zaim (2020) investigated the use of WhatsApp as a mobile learning instrument to enhance writing ability. A review of journal articles and other relevant literature concerning the use of WhatsApp for language acquisition was conducted to collect data. Pupils may utilize WhatsApp's text, voice, picture, and multimedia communication features to hone their writing ability. According to research, WhatsApp can enhance students' writing proficiency in all aspects, including grammar, vocabulary, organization, and mechanics. The methodology entailed the utilization of WhatsApp for pre-writing tasks, such as exchanging pictures and videos to

stimulate ideas; writing tasks, in which students finalize sentence structures and engage in peer revision; and post-writing activities incorporating instructor feedback on recorded work. In general, WhatsApp facilitates opportunities for collaborative learning, free writing practice, instructor feedback, and increased motivation. Compared to traditional classrooms, the interactive WhatsApp platform supports the development of writing abilities by offering additional opportunities for writing practice.

Ahmed (2019) examined and tested the impact of using WhatsApp groups to improve the writing and reading comprehension of twenty undergraduate Yemeni EFL students. Over two months, the students took part in a reading and writing assignment in an English-language WhatsApp group where they conversed and exchanged news stories. Researchers observed the participants, administered a survey, and used pretests and posttests on writing and reading skills. Studying grammar, vocabulary, reading comprehension, and writing length before and after the exam revealed a considerable increase in student performance. Using WhatsApp to learn languages was another good attitude shared by the students in the survey. The opportunities that the WhatsApp group offered for real-world language practice and peer learning improved students' motivation and abilities, particularly in reading and writing. This research suggests that WhatsApp groups are an effective teaching tool for EFL classrooms.

METHOD

Participation

To conduct this study, sixty Omani English EFL learners were chosen randomly from the General Foundation Program in one of the higher education institutions in North Al Batinah, Oman. The participants varied in age from 18 to 19 years, and spoke Arabic as their first language. The students were chosen from the pre-intermediate levels according to their university entrance exam results.

Research Instruments

The following tools were employed in the data-gathering process:

English Grammar Tests.

To quantify the impact of the WhatsApp bot on enhancing English grammar among Omani students, the researcher constructed a pretest, posttest, and delayed posttest to monitor participants' knowledge and development before and after the treatment. Three tests were performed in this study. Every exam comprised two sections, each with fifteen questions, for an overall thirty questions in each test. Each correct answer was assigned a 1 mark. The first part was multiple choice, and the second part was fill-in-the-blank.

Before the examinations, two PhD holders in applied linguistics were selected to ensure the validity of the grammar questions. The candidates were English-language teachers in the Omani EFL context.

To ensure the reliability of these tests, a cohort of twenty-five Omani EFL students from the same institution piloted the examinations. The reliability of this test was 0.850.

Table 1.
The Result of the Reliability Analysis for the Pretest, Posttest, and Delayed Posttest

Cronbach's Alpha	No. of Items
.855	60

Table 1 demonstrates that Cronbach's alpha dependability of the items was 0.85, indicating a comparatively high reliability index of the three sets of tests.

NorthStar GCC 2 Edition Book Series

The researcher consulted authoritative sources to obtain information regarding the comparative and superlative grammar rules. The researcher chose comparative and superlative grammar rules from a listening and speaking skills book published by the NorthStar Gulf Cooperation Council (GCC). The book volume is in its second edition. This book was used as the principal text for the pre-intermediate level in academic institutions. Ten teachings comprised numerous units of the book. The central focus of this investigation was unit three. The short and long adjectives for comparative and superlative grammar rules were taught and covered in unit three.

Interactive WhatsApp Bot

An interactive WhatsApp bot using the Python programming language was designed by a team of programming and language experts and then associated with a local phone number. This phone number was saved by students in the experimental

group on their phones, and adequate instructions were given accordingly. The main purpose of this bot was to send extra explanations and exercises on the two aforementioned grammatical points to the experimental group during their time out of class.

Before beginning treatment, the materials were modified and added to the bot database. Students could start treatment by sending a message to the local number associated with the bot. Upon the start of a conversation with the bot by the students, it sent questions and explanations to the students. After the completion of each section, students received feedback on their answers. In the case of the correct answer, a happy emoji was shared with them; in contrast, the correct answer was sent to them. In this bot, comparatives are first introduced. After three days, the chatbot database was modified and updated based on superlatives. On the last day of treatment, on day 7, the database of the bot was modified, and two grammatical points were available for students to practice and read once more before the posttest.

Procedures

The research was conducted in the autumn of 2023, during a regular academic semester. The study participants were divided into two groups of thirty pupils each: experimental and control groups. Both groups comprised male and female students. Participants were informed that their involvement in the study was voluntary. Both teams adhered to the directives of their instructors in order to study the rules of comparative and superlative grammar. However, the experimental group practiced outside the class by utilizing the WhatsApp assistant. Each student can engage in an infinite number of query repetitions. The researchers guided the experimental group through an advising session, illustrated the utilization of WhatsApp's bot for practicing comparative and superlative grammar rules, and provided instructions to address any potential technical difficulties.

Three weeks of continuous work was required to complete this study. Before commencing the intervention, the researchers administered a pretest to both the groups. During the intervention outside the classroom, the experimental group used the WhatsApp bot to supplement their learning and practice of comparative and superlative grammar rules. However, both groups continued to study and learn comparative and superlative rules according to the instructor's regular instructions, until they fully understood the process. Throughout the treatment period, students communicated with the bot via messages, and the bot processed the exercises in response. The pupils were informed of the accuracy of their responses by the bot, which enabled them to gain insight from their errors. The bot also corrected the students' responses. The treatment duration was one week. The researchers deactivated the WhatsApp automaton during week two and administered a posttest to the control and experimental groups. A delayed posttest was administered to both groups two weeks after the end of the treatment.

Ethical Considerations

Ethical considerations are important in all research endeavors, as compliance with legal provisions presents a formidable obstacle to conducting such investigations without proper authorization. Appropriate notifications were sent to the university, and consent was obtained. In addition, the participants were provided with pre-data collection instructions to read at the study's outset. All individuals who participated in the study did so of their own accord and were assured that any information they provided would be treated with strict confidentiality. In addition, considering academic integrity and plagiarism, some explanations were provided to the students of the experimental group. They also signed a paper clearly stating that they were aware of the study, the material distribution, and the confidentiality of the materials. Students were also given the opportunity to try the assigned tasks and activities more than once with the immediate feedback option, so the stress of cheating and task pressure did not encourage the students to plagiarize. Finally, the identity, group number, and class number of both control and experimental groups remained anonymous to avoid sharing the information.

Data Analysis

To find the best answer for the research question of the present study, a statistical analysis was conducted on the data collected from the students. Table 1 shows the descriptive statistics of all groups in the three sets of examinations.

Table 2. Descriptive Statistics for the Pretest, Posttest, and Delayed Scores of the Two Groups

	N	Min	Max	Mean	SD
Con_Pre	30	4.00	12.00	8.100	2.249
Con_Post	30	8.00	16.00	12.00	2.197
Con_Delayed	30	6.00	14.00	10.233	2.160
Exp_Pre	30	4.00	12.00	7.200	2.340
Exp_Post	30	10.00	19.00	14.800	2.412
Exp_Delayed	30	7.00	15.00	10.400	2.268
Valid N (listwise)	30				

Table 2 reveals that the means of the control group in the pretest, posttest, and delayed posttests were 8.100, 12, and 10.233, respectively. In contrast, the mean scores of the experimental group in the previous tests were 7.200, 14.800, and 10.400, respectively. These data showed that the means of both groups increased significantly in the posttest and delayed posttest. However, more tests need to be conducted to gain in-depth information about student performance.

To select an appropriate test to measure the results of the tests together, a normality test was conducted, and the results are shown in the following table.

Table 3.
Result of the Kolmogorov-Smirnov Test of Normality

	Groups	Kolmogorov-Smirnova		
		Statistic	df	Sig.
Pretest	Control	.155	30	.062
	Experiment	.126	30	.200*
Posttest	Control	.133	30	.183
	Experiment	.200	30	.004
Delayed Posttest	Control	.139	30	.146
	Experiment	.122	30	.200*

As shown in Table 3, the normality of the data distribution was not confirmed for the three sets of tests ($p < .05$), except for the posttest of the experimental group ($p > .05$). Therefore, the non-parametric Wilcoxon test was employed to thoroughly compare the results.

Table 4.
Result of Wilcoxon Test for the Control Group

	Posttest/Pretest	Pretest/Delayed Posttest
Z	-4.799a	-5.203a
Asymp. Sig. (2-tailed)	.000	.000

As can be observed in Table 3, there was a statistical difference in the results of students' scores from the pretest to the posttest and the delayed posttest ($Z = -4.799$, $p < .05$, and $Z = -5.203$, $p < .05$), which shows the effectiveness of the instructions given by the teacher inside the classroom. Table 4 shows the results of students' performance in the experimental group for the three sets of questions.

Table 5.
Result of the Wilcoxon Test for the Experimental Group

	Posttest/Pretest	Pretest/Delayed Posttest
Z	*-4.794a*	*-5.108a*
Asymp. Sig. (2-tailed)	*.000*	*.000*

As can be observed from Table 5, the comparison of the pretest with the posttest and delayed posttest shows a statistical difference, that is, a smooth progress of students from pretest to posttest and delayed posttest as ($Z = -4.794$, $p < .05$, and $Z = -5.108$, $p < .05$), respectively.

Table 6.
The Result of the Mann-Whitney U Test for the Comparison of the Three Sets of Tests Between the Control and Experimental Groups

	Pretest	Posttest	Delayed Posttest
Mann-Whitney U	*344.500*	*181.000*	*442.500*
Wilcoxon W	*809.500*	*646.000*	*907.500*
Z	*-1.574*	*-4.006*	*-.112*
Asymp. Sig. (2-tailed)	*.116*	*.000*	*.911*

As shown in Table 5, the comparison of the pretest, posttest, and delayed posttest revealed that there was no significant difference between the groups in the pretest and delayed posttest because in the pretest, $U = 344.500$, $.116 > 0.05$, and in the posttest, $U = 442.500$, $.911 > 0.05$. However, the results of the posttest showed that the two experimental groups had statistically significantly different results, which could indicate that the experimental groups performed far better than the control group because of the use of the interactive WhatsApp bot. To know more about the size of the difference, Table 6 shows the mean scores of both groups in the posttests.

Table 7.
The Mean Scores of Control and Experimental Groups

Posttest	**Control**	**30**	**21.53**
	Experiment	30	39.47
	Total	60	

DISCUSSION

The present study aimed to design and develop an interactive chatbot using the WhatsApp application to provide better opportunities for Omani EFL learners to engage in some grammatical modules without time and place restrictions. The experimental students received extra material in a few grammatical structures using the interactive WhatsApp bot. The results of the study revealed that compared to the control group, the experimental group that received extra preparations through the WhatsApp bot outperformed significantly. This confirmed that using chatbots in education facilitates efficient teaching and learning processes.

The findings of the current study align with those of Kim (2019), who aimed to measure the impact of implementing chatbots using artificial intelligence to improve grammatical knowledge among Korean students. Seventy undergraduates were divided into two groups. While the control group chatted with a human partner, the experimental group chatted with chatbots for sixteen weeks. After conducting the pretest and posttest to compare both groups, it was found that there was progress among the students in both groups as a result of chatting; however, the results of the experimental group in the posttest showed remarkable and significant differences from their counterparts in the control group.

In another study with similar results, Kharis et al. (2022) developed a type of grammar bot called Gramabot to be employed in online situations during the Covid-19 pandemic to assist in learning and teaching German grammar. Thirty-six Indonesian students with elementary proficiency in the German language were the population of the study, and some information regarding their prior experiences with chatbots and evaluations were gathered accordingly. The results of this study revealed that Gramabot could improve the basic level of grammatical knowledge among these students.

In a study by Safitri et al. (2021), a chatbot called Chatjours was used as an extra medium of instruction to support French learning using the Telegram application. The twenty-two Indonesians in this study were selected from EFL learners at the undergraduate level. The results of this study revealed that chatbot media could be considered an assisting and supporting platform for learning French grammar, which is similar to the results of this study.

In another study that revealed similar results by improving the idea of using WhatsApp to improve grammar, Pamilu et al. (2021) measured the effect of using WhatsApp group discussion on the grammatical competence of students. Interviews with open-ended questions were used to collect data for this study. The results of the study were promising in that the implementation of WhatsApp assisted the students in gaining competency in English grammar.

The results of this investigation support the findings of Sabiq and Fami (2020), who discovered that chatbots functioned effectively as supplementary teacher assistance in academic settings. The chatbots assisted educators in facilitating the distribution of course materials and evaluations. The researchers hypothesized that supplementing teacher-led instruction with chatbots would increase students' enthusiasm and engagement in the learning process.

The outcomes of this study are consistent with those of Yin et al. (2021), who conducted research utilizing chatbot learning to assess student motivation and performance. Despite demonstrating improvements in the learning environment, the results of this study were not deemed statistically significant. Additional research conducted by chatbot experts (Chen et al., 2020; Cheng et al., 2022) discovered that the academic performance of participants was notably impacted by chatbot-based learning.

In another study that revealed similar results, Behforouz and Al Ghaithi (2024) implemented an interactive WhatsApp bot in an English language learning environment to assess its impact on the listening proficiency of Omani EFL learners. The findings of this research demonstrated that the experimental group, which was provided with additional clarification and practice via WhatsApp, achieved superior performance compared to the

control group. Therefore, in the context of Omani EFL, it can be inferred that interactive WhatsApp assistants play a significant role in language instruction and learning.

CONCLUSION

The present study attempted to develop an interactive WhatsApp bot for use as an extra learning source for a few grammatical points. The end of treatment revealed that the students in the experimental group, who received some materials outside of the class as an extra practice, outperformed their counterparts in the control group. However, both groups received traditional face-to-face instruction during their regular classes.

The results of this study can help teachers, institutions, and students. Using interactive WhatsApp bots or any other useful chatbot allows teachers to engage students through channels where they seem busy (i.e., mobile phones). This allows teachers to send more materials without any time and place restrictions, which is also a common advantage for students. Concurrently, the students would be active in the learning environment if they missed one or more of their classes because they could interact with the chatbots and receive feedback on the spot. These chatbots also help institutions work efficiently and accurately. In most institutions, academic advising sessions, student evaluation systems, and other administrative work currently spend too much time and energy on paperwork and human and nonhuman resources due to time and class restrictions. Using chatbots will be helpful in collecting a large amount of data promptly and accurately and will allow the students to access the questions anywhere to read, understand, and reply to the work.

This study has limitations that could be new research areas for academicians of similar research interests.

- The first limitation of this study could be the risk of its generalizability of the current paper. Since only sixty Omani students with pre-intermediate English proficiency levels from one private institution were included in this study, it is challenging to generalize the results across the Omani EFL context. Therefore, it is recommended that more data be collected on various English proficiency levels and institutions to achieve this goal.
- To conduct this study, very few grammatical points were selected and distributed among the participants of the experimental group: comparatives and superlatives. Further suggestions could be made to use chatbots in many grammatical structures to know more about the reliability of chatbots in grammar learning.
- Since the study was conducted during the students' regular semester, both groups received instructions from their teachers in the class. The results of the study might be affected by the quality of teaching that teachers provide in their classes, and the WhatsApp bot acted as the facilitator of learning. Therefore, it would be better if there were no instructions for either group to better understand teaching grammar through chatbots and the WhatsApp bot in this study.
- Another limitation of this study could be the interference of external factors with the results of the participants. Anxiety, stress, class pressure, and the number of tasks they received from their instructions are all factors that can cause different results. It is suggested that future researchers assign the same amount of work to their students to obtain better results and understand the usefulness of chatbots more comprehensively.
- Another limitation is the technological literacy of the participants in both groups. It is possible that there were more participants in the experimental group in the technology group than in the control group. Therefore, it is suggested that future scholars ensure the homogeneity of participants using technology at the same level.

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