Jurnal Teknik dan Keselamatan Transportasi

ISSN: 2622-0105 (print) | 2716-1196 (online)
http://jurnal.poltekbangmakassar.ac.id/

Enhancing Aviation English Vocabulary Through ChatGPT-Assisted Learning: A Quasi-Experimental Study of Air Traffic Management Trainees

Nining Idyaningsih[1*], Muhammad Sayyed Mulki[2], Ahmad Rossydi[3], Suhanto[4], Wahyuni Oktavia[5]
[1,2,3,4]Politeknik Penerbangan Makassar, Politeknik Pelayaran Surabaya[5]

***Correspondence:**
ondeng77@gmail.com

Article info

Received: 18-09-2025
Final Revision: 16-12-2025
Accepted: 22-12-2025
Available online: 28-12-2025

Keywords:

aviation english; generative artificial intelligence; ChatGPT; english for specific purposes; quasi-experimental design; ICAO Language Proficiency

ABSTRACT

The research evaluates how ChatGPT-based teaching methods help air traffic controller trainees at Politeknik Penerbangan Makassar develop their Aviation English vocabulary skills. Given the critical role of standardized Aviation English in ensuring operational safety and compliance with ICAO Language Proficiency Requirements, innovative, interactive instructional approaches are needed to overcome the limitations of conventional, textbook-based teaching methods. Employing a quantitative quasi-experimental one-group pre-test–post-test design, the study involved 12 D3 Air Traffic Management students who had completed on-the-job training. The educational program employed ChatGPT to assist students in learning aviation terminology through interactive activities and pilot-air traffic controller role-play sessions, which provided immediate feedback for safe language practice. Data were collected using validated and reliable pre-test and post-test instruments and analyzed through descriptive statistics and the Wilcoxon Signed Rank Test due to non-normal data distribution. The findings reveal a statistically significant improvement in students' Aviation English vocabulary performance following the intervention ($p = 0.002$), with a substantial mean gain score of 46.48 points. The results of the effect size analysis show that the practical effect size is 0.88, indicating that the instructional method has a significant and strong impact. The research demonstrates that ChatGPT provides students with an effective vocabulary-learning experience through its interactive elements, which create a comfortable environment for them to practice aviation technical language in real-world scenarios. The research establishes strong experimental results that demonstrate that properly designed generative artificial intelligence systems function as useful additional resources for English for Specific Purposes (ESP) education in aviation training programs.

Reccomended Citation:

APA Style

INTRODUCTION

The safety and operational efficiency of aviation depends heavily on Aviation English communication which needs to be both effective and accurate. The International Civil Aviation Organization (ICAO) has established Aviation English proficiency standards that pilots and Air Traffic Controllers (ATC) must meet to ensure effective communication across all operational scenarios, including emergency responses. The

International Civil Aviation Organization (ICAO) requires all aviation personnel who work as ATC staff to reach ICAO English Language Proficiency (IELP) Level 4 for their operational duties. This emphasizes the importance of learning Aviation English specific to aviation, which students at Makassar Aviation Polytechnic and other aviation education institutions in Indonesia must master.

Although important, learning Aviation English is often hampered by limitations in the application of interactive and effective methods. Conventional learning in many aviation education institutions tends to rely on textbooks and limited face-to-face learning. The teaching method creates a risk that students will lose their English abilities when they encounter real-life situations. Only 50% of students in the ATC XV study program meet the minimum English language proficiency standards required for the ICAO passing exam. The figure demonstrates that theory exists in a separate domain from practice in this particular field. Makassar Aviation Polytechnic, as one of the aviation education institutions in Indonesia, plays an important role in preparing students who not only possess technical skills in aviation but also English proficiency in accordance with ICAO standards. Students encounter ongoing difficulties understanding and using English in their aviation education. The weakness appears in three elements: Aviation English uses restricted technical terms, students struggle to understand technical directions, and they lack self-assurance when using English for aviation operations.

Some factors that cause the low ability of students in Aviation English include: (1) The limited English-speaking environment causes students to use Indonesian more often in everyday communication, which has an impact on low opportunities to practice English in everyday life, both from an aviation and a general context. (2) The lack of access to interactive learning media and still relying on textbook learning methods and conventional materials provides less direct practical experience. (3) Low learning motivation by some students feel less motivated in learning English. The implementation of technological solutions provides an effective answer to resolve these learning problems, which affect Aviation English education. One technology that is rapidly developing and proven effective for improving Aviation English skills is ChatGPT. ChatGPT, developed by OpenAI, is a text-and voice-based artificial intelligence model that can be used for a variety of educational purposes, including learning Aviation English. ChatGPT allows students to practice English conversations interactively and instantly. The system lets users have real conversations by providing instant feedback that automatically edits their language. By using ChatGPT, students can practice communicating in aviation situations independently, without relying entirely on instructors or face-to-face meetings.

Research shows technology serves as an educational tool that improves English language education in conventional schools and English for Specific Purposes (ESP) programs. Yakob (2023) found that artificial intelligence tools used in language learning help students develop stronger language skills, build confidence, and better identify language mistakes. Juliana's (2022) research demonstrated that Indonesian classrooms that implemented technology-based educational methods achieved better student outcomes in vocabulary learning and writing. The field of Aviation English delivers education through blended learning systems that combine classroom instruction with online components and technology-mediated instruction. The research by Rossydi et al. (The research conducted by (2023) showed that hybrid learning-based instruction successfully kept students interested during their Aviation English education at Indonesian vocational higher education institutions. The development of new teaching methods has not led to enough research about how students use ChatGPT for learning Aviation English. The existing gap requires researchers to conduct a thorough study about how AI tools can help students learn vocabulary in their aviation communication work which needs strict safety regulations. The current research investigates ChatGPT-assisted learning methods through empirical evidence to determine their effectiveness in teaching Aviation English vocabulary to Air Traffic Management students.

Based on the identified research problem, the primary objective of this study is to examine and evaluate the effect of ChatGPT-assisted instruction on students' vocabulary mastery at Politeknik Penerbangan Makassar, particularly within the context of Aviation English. The research aims to improve aviation education through educational programs which use technological learning approaches. Research has shown that artificial intelligence tools help students improve their general English abilities but there is insufficient evidence about their use in Aviation English which requires specific language skills for safe operational activities. The research investigates how ChatGPT functions as a teaching tool to help students learn aviation-related words which represent the main focus of this study.

Guided by the research objectives, theoretical framework, and problem formulation, this study employs a quantitative, quasi-experimental design to test the relationship between the independent and dependent variables. The independent variable (X) consists of using ChatGPT for Aviation English teaching which provides students with aviation-related vocabulary practice and simulated communication activities. The dependent variable (Y) is students' Aviation English vocabulary proficiency, as measured through pre-test and post-test assessments

administered to XV Air Traffic Management students. Accordingly, two hypotheses were formulated. The null hypothesis (H_0) posits that ChatGPT use has no significant effect on students' Aviation English vocabulary proficiency at Politeknik Penerbangan Makassar. The alternative hypothesis (H_1) demonstrates that students who use ChatGPT for learning will achieve better Aviation English vocabulary knowledge at a statistically significant level. The research uses quantitative statistical methods to perform hypothesis testing, which evaluates if the measured learning achievements result from the ChatGPT-based educational approach.

This hypothesis can be tested experimentally by comparing the values in the experimental group of students before and after the ChatGPT intervention. Aviation English proficiency was measured after the intervening period, using tests relevant to Aviation English. Comparing pre-test and post-test results will allow us to determine whether there is a significant improvement in abilities in the experimental group using ChatGPT. Thus, this study aims to test the formulated hypothesis and determine whether the use of ChatGPT can significantly improve Aviation English students' abilities at Makassar Polytechnic.

Aviation English is a specific English language variant that pilots, air traffic controllers (ATC), and flight operations staff use for aviation communications. The International Civil Aviation Organization (ICAO) established Aviation English as the international aviation communication standard to reduce communication errors, which improve operational safety. The ICAO Document 9835 Manual on the Implementation of ICAO Language Proficiency Requirements states that multiple aircraft accidents have demonstrated that English language proficiency deficits are the primary reason, as staff members are unable to deliver operational instructions in basic English (ICAO, 2010).

The Language Proficiency Requirements (LPRs) that ICAO established serve to protect against these potential risks by establishing basic English proficiency levels for pilots and air traffic controllers. The process to establish these requirements began at the 32nd ICAO Assembly Session in 1998, after multiple fatal accidents revealed that pilots' inadequate English skills played a role in the crashes. Member States of ICAO have established standardized training programs to follow LPRs and prevent future accidents since the incident (Eurat, 2023). The minimum radiotelephony communication proficiency required by ICAO Level 4 (Operational Level) is specified in Annex 1 (Personnel Licensing) and Document 4444 (Air Traffic Management), while Levels 5 (Extended) and 6 (Expert) demonstrate advanced communicative abilities (ICAO, 2006). The ICAO Language Proficiency Scale assesses six fundamental language abilities that pilots need to maintain safe aviation operations through their communication: pronunciation and grammatical structure, vocabulary, fluency, comprehension, and interaction. The ability to master vocabulary is the most important element, as aviation communication requires precise technical terms and specific phrases that vary with the situation. Insufficient vocabulary skills among personnel lead to incorrect interpretations, resulting in longer response times and elevated operational risks, as they need to act quickly during emergency responses.

The aviation training industry continues to face challenges because students do not meet ICAO Level 4 language standards despite extended language proficiency training. Conventional teaching approaches fail to give students enough opportunities to practice their skills in real situations while they receive instant feedback during their Aviation English studies. The need for new teaching methods has emerged because students require interactive learning spaces that offer genuine experiences and individualized learning to help them build vocabulary skills. The educational tool ChatGPT, along with other generative artificial intelligence systems, provides instructors with innovative methods to teach Aviation English through simulated operational dialogues, instant feedback, and adaptable practice activities that follow ICAO standards.

With the development of technology, Aviation English learning methods have changed from traditional to more technology-based approaches, such as computer-based simulations, mobile learning applications, and online learning systems (e-learning). The aviation industry relies on Aviation English as its primary communication system, enabling pilots, ATC personnel, and other aviation staff to exchange information safely and effectively. With the increasing complexity of aviation operations and the growth of global air traffic, effective use of Aviation English is more important than ever. Modern learning methods, including digital technology, e-learning systems, and AI-based simulation platforms, enhance the effectiveness of Aviation English training programs. The development of technology needs researchers to create improved Aviation English learning approaches, which will strengthen international aviation safety protocols.

Construction theory holds that language learning occurs through active interaction among different sources of information, and that technology, such as ChatGPT, can be an effective medium for building new knowledge in the context of Aviation English. Students in Aviation English learning programs use technology to access learning materials through Learning Management Systems (LMSs), e-learning applications, and artificial intelligence (AI) simulations. Technology also involves students interacting with instruction and peers

in an online environment, thereby enhancing their learning. The concept of development holds that learning is an active process in which learners build themselves through learning. The theory supports language learning through technology because it enables students to experience authentic learning through multimedia tools and simulation software and online communication platforms. According to the Journal, constructivist learning theory emphasizes active student participation in the learning process. Active participation as a publisher of construction theory can be done in thematic learning. Ongoing learning in Indonesia today is theme learning, which is integrated learning that uses themes to understand several subjects, so that it can be useful learning for students (Abdiyah & Sunan Kalijaga Yogyakarta, 2021)

ChatGPT is an artificial intelligence-based application that enables interactive text-based conversations. Students who learn English can use ChatGPT to develop their conversation skills through independent practice which provides them with instant feedback about their language accuracy and speech delivery. ChatGPT is interpreted in this study as a technology-based tool used to improve students' English abilities. In the context of Aviation English, ChatGPT provides an opportunity to practice everyday conversation as well as the technical communication required in the aviation world. The study by Cohen & Zhang (2021) shows that chatbots let students study foreign languages by having real English dialogues which establish a relaxed learning space. ChatGPT gives students the opportunity to practice with a responsive AI system that can provide relevant feedback in aviation contexts.

The integration of chatbots and AI systems in language learning provides students with an interactive learning space that uses real-time communication practice to adapt to their individual needs. Students can use AI-powered chatbots including ChatGPT to create realistic dialogues with their teachers and classmates which helps them develop Aviation English skills in a safe educational space. These systems provide students with endless practice opportunities through their continuous operation which does not need direct supervision from their teachers. The system provides students with three main educational benefits which include flexible learning at any time and lower communication stress and step-by-step conversation practice with instant computer-based feedback. The system includes particular features which assist students who need English for essential communication duties in their aviation education.

The educational system uses AI-based conversational tools that operate through collaborative digital platforms, including Google Docs, Slack, and Zoom, to improve student learning in group-based and project-oriented activities. The tools allow students to work together on their English aviation communication assignments which include creating standard operating procedures and developing role-play scenarios and analyzing flight-related cases. Students develop better teamwork abilities through collaborative technologies which support cooperative learning to improve their abilities in working with peers and solving problems. The platforms enable users to work together on learning projects which help them develop their language abilities and their professional communication skills needed for aviation work.

Text-based simulations and role-playing games (RPGs) which operate in aviation environments provide students with an active method to develop their Aviation English skills. The simulation environment requires participants to take on professional duties which include operating as pilots and air traffic controllers and passengers who need to navigate actual flight conditions. The activities serve to teach technical aviation terms while helping students develop their English skills for working in various operational environments. Simulation-based learning enables students to develop their language skills through real-world scenarios which enhance their understanding and their ability to use language correctly in practical situations that are essential for English for Specific Purposes (ESP) education in aviation.

The research design incorporates these educational principles to achieve three main objectives which include (1) determining how ChatGPT-based learning affects students' ability to remember and use Aviation English words at Politeknik Penerbangan Makassar and (2) assessing the success rate of ChatGPT in teaching Aviation English vocabulary to aviation students and (3) developing evidence-driven strategies to implement ChatGPT in Aviation English teaching at Poltekbang Makassar. The research objectives enable researchers to determine how AI-based educational resources enhance the quality of Aviation English education and develop effective student strategies to meet ICAO Language Proficiency (IELP) examination standards.

METHOD

This study uses a quantitative approach with a quasi-experimental design of one group pre-test and post-test (one group pre-test and post-test design) designed to measure the effect and effectiveness of the

use of ChatGPT in improving students ' vocabulary skills in Aviation English courses at Makassar Aviation Polytechnic. A quantitative approach was chosen because this study aims to examine the relationship between ChatGPT use (independent variable) and improvements in vocabulary among XV Air Traffic Management students in Aviation English (dependent variable). The method enables researchers to obtain measurable data that they can analyze statistically to establish if ChatGPT enhances students' English abilities. The reasons for choosing a quantitative approach are: (a) Objective measurement: the quantitative approach allows measuring changes in students ' Aviation English skills using objective instruments, such as pre-test and post-test. (b) Hypothesis testing: this approach allows testing hypotheses about the effect of ChatGPT use on Aviation English students' Aviation English ability. (c) Statistical analysis: The Shapiro-Wilk test must be run to assess data normality, as it is required for the t-test. If the data are not normally distributed, nonparametric tests should be used as an alternative. The collected Data can be analyzed using statistical tests, such as the t-test, to determine whether there is a significant difference between the pre-test and post-test. This study used a quasi-experimental one-group design, with research representatives in the experimental group who studied Aviation English. The research design enables researchers to determine how ChatGPT enhances students' vocabulary knowledge in Aviation English.

An independent variable is a variable that affects or causes changes in other variables. In this study, the variable used is the use of ChatGPT in learning Aviation English. ChatGPT is an artificial intelligence tool used to help students practice in an aviation context. The use of ChatGPT allows students to practice English conversations relevant to communication in the world of aviation in an interactive, flexible, and accessible at any time. The dependent variable serves as the measurement point, helping researchers determine whether the independent variable leads to changes. In this study, the dependent variable is students' vocabulary in Aviation English. This dependent variable measures students' understanding of Aviation English in the context of aviation, including proper use of technical vocabulary and communication practices, for example, conversations between pilots and Air Traffic Controllers (ATC). The population in this study comprised students at Makassar Aviation Polytechnic enrolled in the Air Traffic Management program and studying Aviation English. The population of this study consists of individuals who have undergone On-the-Job Training. The study population comprised 24 students from the Management Study Program XV Air Traffic at Makassar Aviation Polytechnic. Twelve students were selected using the purposive sampling technique. The category is a study program for the students who are currently studying in the D3 Air Traffic Management program. The second reason was the language used; students studying Aviation English in an aviation context, with a focus on mastering vocabulary in aviation situations. This population was chosen because students involved in OJT in the aviation industry directly relate to the use of Aviation English and have real experience in aviation communication in the airspace. This is very relevant to the study's purpose of examining the effect of ChatGPT use on improving Aviation English ability.

The evaluation of post-test results requires descriptive statistical methods for the first requirement. The descriptive statistics present a summary of the entire dataset through its average values and standard deviations, as well as the pre-test and post-test value distributions. Its purpose is to provide a general overview of the distribution of student scores on both Tests and to show whether there is a trend of improvement in English Aviation ability after using ChatGPT. The analysis used Microsoft Excel to calculate average values, standard deviations, and value distributions. (b) The Output obtained will help researchers understand the level of change in students ' vocabulary skills from pre-test to post-test. After descriptive statistics, we test for a significant difference between the post-test and pre-test using a t-test. This test is used to compare post-test and pre-test averages in experimental groups and to test hypotheses. The research investigated whether students who used ChatGPT would achieve significant improvement in their Aviation English vocabulary skills. If the data are not normally distributed, the researcher will use a nonparametric statistical analysis, namely the Wilcoxon signed-rank test, using SPSS 22 for Windows. The researchers chose the Wilcoxon test because their study involved a small number of participants, as noted by Beti Arliana and Darma Ramtia (2022). The research employed two main tools which included SPSS Windows 22 for hypothesis testing and Microsoft Excel for experimental group value significance assessment. (b) The t-test output contains a p-value, which helps users determine if the observed difference between groups is large enough to prove the null hypothesis incorrect.

The Microsoft Excel 2025 Application enables researchers to evaluate the strength of their data evidence for research objectives by assessing the maximum and statistically meaningful achievement. Quantitative research methods enable researchers to obtain reliable empirical evidence on treatment success and goal attainment through predefined data collection methods. To measure the effectiveness and support of this study to test the formulation of the problem, the right partner in the data effectiveness test, if it is used, is the Wilcoxon Signed Rank Test, in testing the influence, which is the Effect Size test (Fadhila Kusuma Hati & Bayu Setiaji, 2024), using the formula.

RESULTS AND DISCUSSION

The study was conducted at an on-the-job training (OJT) site and involved 12 students from the D3 Air Traffic Management Study Program (Class XV) at Politeknik Penerbangan Makassar. Participants were selected using purposive sampling based on their enrollment in Aviation English courses and direct exposure to aviation communication contexts. Data collection was carried out in three stages: pre-test administration, implementation of the ChatGPT-assisted learning intervention, and post-test administration. All research instruments, particularly the Aviation English vocabulary test, were examined for validity and reliability and confirmed through expert judgment. The collected data were subsequently analyzed using appropriate statistical procedures based on the data distribution. A summary of the pre-test and post-test results is presented in the following table:

Table 1. Research data results

No	Student Name	Pre-test Scores	Post-test Scores	Difference
1	1	33.2	83	49.8
2	2	58.1	91.3	33.2
3	3	66.4	91.3	24.9
4	4	33.2	83	49.8
5	5	33.2	100	66.8
6	6	41.5	83	41.5
7	7	33.2	91.3	58.1
8	8	66.4	100	33.6
9	9	58.1	100	41.9
10	10	49.8	91.3	41.5
11	11	41.5	91.3	49.8
12	12	33.2	100	66.8
AVERAGE GAIN				46,48

Table 1 presents the comparison between pre-test and post-test scores. The results show a consistent increase in post-test scores for all participants. Individual gain scores ranged from 24.9 to 66.8, with an average gain of 46.48 points, indicating a substantial improvement in Aviation English vocabulary mastery following the intervention.

The results of the pre-test are used to compare the post-test value. In this study, using the SPSS application, the following graphs were generated from the output in the SPSS application:

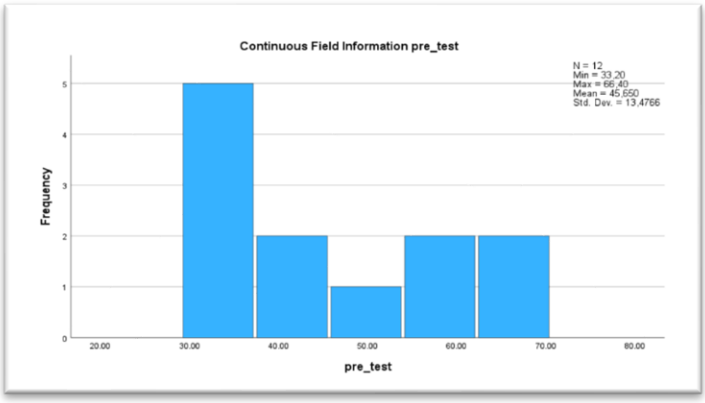

Figure 1 SPSS Pre-Test Output

Based on the histogram of pre-test values, 5 participants (out of 12) scored in the 30-40 range. The average pre-test score was 45.65, with a standard deviation of 13.48, indicating considerable variation in scores between participants. The minimum score obtained is 33.20, and the maximum score is 66.40. The distribution pattern on the histogram looks skewed to the right (positively skewed), where most of the values are below the average. This shows that, before treatment (in this case, ChatGPT), most students still have low to medium initial abilities.

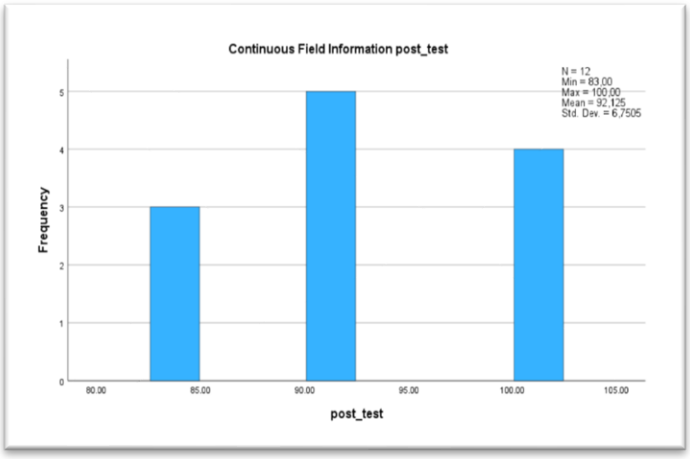

Figure 2: Output of post-test SPSS

Based on the histogram of post-test scores, from 12 students who participated in the treatment, as many as 5 students obtained scores in the range of 90-95, and 4 students obtained a perfect score (100). The post-test average was 91.125, and the standard deviation was 6.75. All participants scored above 83, indicating very good, consistent improvement in learning outcomes after using ChatGPT during the learning process. The research data shows that students who enroll in Aviation English education programs will improve their academic performance. The treatment program produced substantial score improvements, indicating that the educational materials and teaching approaches were effective. The pre-test results showed that students had basic abilities that needed improvement, as their average score remained low. The learning session resulted in substantial post-test score improvements for all participants except one. The learning process follows learning theory principles which show that student-centered learning structures enable students to reach higher academic success in their field of study.

The Shapiro–Wilk test results showed that the measured data did not follow a normal distribution pattern. Therefore, the Wilcoxon Signed Rank Test was applied. The results revealed a statistically significant difference between pre-test and post-test scores ($p = 0.002$, $p < 0.05$), leading to the rejection of the null hypothesis and confirmation of a significant effect of ChatGPT-assisted learning on students' Aviation English vocabulary skills. To assess the magnitude of this effect, an effect size analysis was conducted using the Wilcoxon Z statistic. The results yielded a large effect size ($r = 0.88$). The established benchmarks show that any r value above 0.5 indicates a strong practical effect, which proves that the observed improvement surpassed statistical significance to create meaningful educational changes.

The substantial improvement in students' vocabulary performance and the large effect size ($r = 0.88$) can be attributed to several pedagogical mechanisms inherent in ChatGPT-assisted learning. ChatGPT provides students with immediate, ongoing feedback, which helps them verify their aviation terms by practicing and reviewing them right away. The interactive process between students and teachers follows the same pattern as virtual learning environments, which research indicates will boost student involvement in English for Aviation education (Rossydi & Masita, 2021). The system allows students to participate in simulated conversations between pilots and air traffic controllers, which mimic real operational dialogue to help them learn new words in meaningful situations.

The interactive and adaptive features of ChatGPT system helped students decrease their affective filter which included their anxiety when they needed to use high-stakes aviation communication. Research on virtual and online language learning shows that educational technology platforms create learning spaces that help students become more engaged and build their self-confidence (Oktavia, Rossydi, &

Kurnianto, 2021; Rossydi & Masita, 2021). Students in traditional educational environments tend to avoid practicing technical terms because they worry about committing mistakes when others observe their work. Students can use ChatGPT to develop their language skills in a risk-free environment, where they can try different words without fear of criticism, thereby building their self-confidence and improving their ability to remember words.

The intervention design follows constructivist learning theory, as students develop knowledge through active engagement with their surroundings through intentional activities. Through its dialogic function, ChatGPT enables students to take an active role in meaning-making rather than simply memorizing vocabulary terms by rote. The research design follows previous virtual engagement studies, which show that interactive digital platforms help students learn effectively while keeping them interested in their English for Specific Purposes (ESP) courses (Oktavia et al.,2021; Rossydi & Masita, 2021). The instructional model is a vital component of Aviation English education because students need to learn specific vocabulary that works in specific situations for safe and effective communication.

The research results have direct value for understanding ICAO Language Proficiency Requirements, including ICAO Level 4 standards that focus on the correct and operational use of aviation terminology. The participants achieved a post-test mean score of 91.13, indicating they reached the required technical lexical skills for ICAO Level 4 compliance and reduced the identified proficiency gap. The research findings show that students learned the particular aviation security vocabulary through their use of ChatGPT as a learning tool. The research results confirm earlier studies (Juliana, 2022; Yakob, 2023) that show that artificial intelligence technology leads to better student outcomes in language learning. The current research builds on previous studies by showing that generative artificial intelligence works best for specific English for Specific Purposes (ESP) fields, including Aviation English, which requires precise word choice, proper terminology, and clear communication. The research results show that ChatGPT functions as an educational resource that provides strong pedagogical value for teaching vocabulary while keeping students engaged and ready for professional aviation language use.

CONCLUSION

The research proves through empirical evidence that students achieve better results in aviation terminology when ChatGPT integrates into Aviation English teaching approaches. The research employed a quantitative quasi-experimental one-group pre-test–post-test design which showed learning outcomes improved significantly at a p value of 0.002 while maintaining a p value below 0.05. The results showed a significant mean gain score of 46.48 points. The observed improvement shows both statistical significance and educational value because of its large effect size which equals 0.88. The study shows that students can improve their vocabulary through ChatGPT-based learning which provides them with interactive activities that mimic real aviation communication between pilots and air traffic controllers. The system provides learners with instant feedback through its low-stress learning space which helps them participate directly with technical terms to achieve better lexical understanding and build their self-assurance. The teaching method uses constructivist and blended learning approaches which let students learn through educational approaches that serve their individual requirements.

The post-test results show significant improvement which demonstrates students' growing ability to achieve ICAO Language Proficiency Requirements at Level 4 for safe aviation communication. The research provides value to educational artificial intelligence studies because it shows how to use artificial intelligence in English for Specific Purposes (ESP) and vocational aviation training programs. Despite its promising findings, this study is limited by its relatively small sample size and one-group research design. Research needs to investigate student language development through ChatGPT-based learning by studying larger participant numbers and controlled groups who receive extended observation periods. The research should investigate student language development through ChatGPT-based learning by studying participants who speak different languages and who have varying language abilities. The research results confirm that ChatGPT should become an additional teaching resource for Aviation English education which will help students develop their professional language skills in aviation training centers.

REFERENCES

Abdiyah, L., & Universitas Islam Negeri Sunan Kalijaga Yogyakarta. (2021). Penerapan teori konstruktivistik dalam pembelajaran tematik di sekolah dasar. ELSE (Elementary School Education Journal), 5.

Amalia, D., & Wirawati, D. (2023). Pemanfaatan teknologi digital dalam pembelajaran bahasa Indonesia. Jurnal Bahasa, Sastra, dan Pengajaran, 12, 113–230. http://jurnal.unsur.ac.id/ajbsi

Arliana, B., & Ramtia, D. (2022). Peningkatan self-disclosure melalui bimbingan kelompok pada siswa kelas X di SMA Negeri 1 Rambang Niru. *Jurnal Pendidikan dan Konseling*, *4*(4), 1120–1123.

Cohen, A. D., & Zhang, W. (2021). Using chatbots for second language learning: Opportunities and challenges. *Language Learning & Technology*, *25*(3), 1–15.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications. https://us.sagepub.com/en-us/nam/research-design/book246881

Eurnat, I. (2023). European and North Atlantic Office guidance on the harmonized implementation of language proficiency requirements and its oversight. International Civil Aviation Organization.

Garrison, D. R., & Vaughan, N. D. (2008). Blended learning in higher education: Framework, principles, and guidelines. Jossey-Bass. https://doi.org/10.1002/9781118269558

Hati, F. K., & Setiaji, B. (2024). Pengembangan e-modul fisika untuk meningkatkan kemandirian belajar dan kemampuan berpikir kritis peserta didik. *Jurnal Pendidikan Fisika*, *11*(1), 56–65. https://doi.org/10.21831/jpf.v11i1.20519International Civil Aviation Organization. (2006). Annex 1 – Personnel licensing (Vol. 823). ICAO.

International Civil Aviation Organization. (2010). Manual on the implementation of ICAO language proficiency requirements (Doc. 9835). ICAO.

Juliana, J. (2022). Role of technology in innovating English teaching to improve learning outcomes in the digital world. International Journal of Linguistics, Literature and Culture,8(4),111–122.https://doi.org/10.21744/ijllc.v8n4.2095

Lutfiyatun, E., Kurniati, D., & Fajriah, N. (2021). Teori dan praktik pengajaran bahasaberbasisteknologi.https://epublisher.my.id/index.php/ptakm/article/download/113/107

Mashau, P., & Nyawo, J. (2021). The use of an online learning platform: A step towards e-learning. South African Journal of Higher Education, 35(2). https://doi.org/10.20853/35-2-3985

Pan, X. (2023). Online learning environments, learners' empowerment, and learning behavioral engagement: The mediating role of learning motivation. SAGE Open, 13(4). https://doi.org/10.1177/21582440231205098

Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 87 Tahun 2021 Tentang Peraturan Keselamatan Penerbangan Sipil Bagian 69 Tentang Lisensi, Rating, Pelatihan, dan Kecakapan Personel Navigasi Penerbangan. (2021, 2 Desember). https://peraturan.bpk.go.id/Home/Details/202692/pm-no-87-tahun-2021

Rosenthal, R. (1991). Meta-analytic procedures for social research (Rev. ed.). SAGE.

Rossydi, A., & Masita, M. (2021). The Implementation of Virtual Classroom in English for Aviation. Ethical Lingua: Journal of Language Teaching and Literature, 8(1), 260–268. Retrieved from https://www.ethicallingua.org/25409190/article/view/284

Rossydi, A., Atmowardoyo, H., Weda, S., & Muliati, M. (2023). Hybrid Learning-based Instruction in Teaching Aviation English for Cadets“ A Case Study at Vocational Higher Education Indonesia. *Journal of Innovation in Educational and Cultural Research, 4*(4), 663-672. doi:https://doi.org/10.46843/jiecr.v4i4.922

Somadayo, S., Jamil, M., & Karim, H. K. (2024). Pengembangan media pembelajaran bahasa Indonesia berbasis teknologi augmented reality. *Journal of Education Research, 5(1), 562–569. https://doi.org/10.37985/jer.v5i1.733*

Sugiyono. (2016). Metode penelitian kuantitatif, kualitatif, dan R&D (Edisi 14). Alfabeta. https://www.alfabeta.co.id/product/metode-penelitian-kuantitatif-kualitatif-dan-r-d-edisi-14

Oktavia, W., Rossydi, A., & Kurnianto, B. (2021). Psycholinguistic Study: Virtual-Engagement in Online Learning. Airman: Jurnal Teknik Dan Keselamatan Transportasi, 4(2), 80–89. https://doi.org/10.46509/ajtk.v4i2.182

Widyaruli, A. (2022). Kajian model blended learning dalam jurnal terpilih: Implementasinya dalam pembelajaran. Kajian Bahasa, Sastra Indonesia dan Pembelajarannya, 1(4). https://etdci.org/journal/AUFKLARUNG/index

Wicaksono, A. W., et al. (2022). Disrupsi dunia pendidikan penerbangan Indonesia ChatGPT: Analisis dampak penggunaan ChatGPT pada pendidikan vokasi penerbangan.https://pdfs.semanticscholar.org/496b/88b70a731db2910409a061443c1db1199a51

Yakob, R., Huljannah, M., & Wahyuni, S. (2023). Pembelajaran bahasa yang didukung AI: Meningkatkan kemampuan bahasa Inggris. BaJET: Bahasa dan Jurnal Edukasi Terapan, 7(2), 476–479. http://journal.unbara.ac.id/index.php/BaJET

Zisca Diana, P., Wirawati, D., & Rosalia, S. (2020). Blended learning dalam pembentukan kemandirian belajar. Bahasa, Sastra dan Pengajaran, 9, 16–21. http://jurnal.unsur.ac.id/ajbsi