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## ChatGPT in the Classroom: A Practical Guide for Educators

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## Abstract

This paper explores the potential applications of ChatGPT, a powerful Artificial Intelligence (AI) large language model (LLM) developed by OpenAI, for aviation education applications. The authors provide an overview of ChatGPT and its unique features, such as accessibility, conversational abilities, and personalized learning capabilities. The scalability of ChatGPT allows individualized and personalized instruction, a revolutionary aspect that can potentially enhance the student learning experience. This applied research employed an exploratory design to investigate ChatGPT's potential applications to enhance learning at varied levels of learning. The study investigated four research questions: (1) How can ChatGPT be used by students to support learning at each stage of Bloom's Taxonomy?; (2) How can teachers use ChatGPT to enhance student engagement in the learning process at each stage of Bloom's Taxonomy?; (3) What are the potential risks related to using ChatGPT as an educational resource?; and (4) What student guidelines or policies should be in place regarding the use of ChatGPT for learning? The authors provide specific recommendations for entering ChatGPT queries, along with practical application samples that have been tested using the platform. Generalized guidance and policy for the educational use of ChatGPT is also provided. The findings of this project prepare instructors to apply AI LLM resources to enhance aviation education and provide recommendations for its effective and ethical use by both faculty and students. Overall, this paper equips aviation educators with the necessary knowledge to leverage the power of ChatGPT to improve instructional outcomes.

*Keywords:* AI, ChatGPT, LLM, Bloom's Taxonomy

University aviation educators constantly search for innovative ways to engage their students and enhance their learning experience. ChatGPT is a powerful artificial intelligence (AI) large language model (LLM) developed by OpenAI. This *chatbot* technology—a computer program simulating human conversation—can potentially revolutionize how aviation education is delivered. Chatbots are advantaged by their ability to scale information delivery, interact with many students in a one-on-one fashion, and provide customized delivery techniques and interactions that meet the learning needs of each student.

This paper highlights how ChatGPT can be leveraged to provide a personalized and interactive learning environment for aviation-focused content, making it a valuable tool for educators to use for course enhancement. The authors further aim to explore potential ChatGPT applications, make recommendations on how to embrace this technology effectively, and provide guidance for educational policy regarding the use of generative AI technology.

### **Research Questions**

This study's main objective is to explore the integration of ChatGPT as an educational tool within aviation education. Four research questions were investigated:

- (1) How can ChatGPT be used by students to support learning at each stage of Bloom's Taxonomy?
- (2) How can teachers use ChatGPT to enhance student engagement in the learning process at each stage of Bloom's Taxonomy?
- (3) What are the potential risks related to using ChatGPT as an educational resource?
- (4) What student guidelines or policies should be in place regarding the use of ChatGPT for learning?

These questions directly support the objective by addressing various aspects of ChatGPT's use in education. They explore its application across Bloom's Taxonomy stages, the enhancement of student engagement, the identification of potential risks, and the establishment of necessary guidelines. The questions specifically target aviation education, acknowledging the unique context of this field. The research questions cover different dimensions of ChatGPT's integration into aviation education. They address both student and teacher perspectives, potential risks, and the need for guidelines, providing a well-rounded exploration of the topic.

### **Significance of the Study**

Cotton et al. (2023) highlight risks associated with ChatGPT use in education, including the increased potential for student cheating or plagiarizing. Kasneci et al. (2023) highlight the potential for student overreliance on the tool and the potential for ChatGPT to exacerbate existing societal biases or unfairness in its responses that may taint student opinions. Kasneci et al. (2023) further point to educator knowledge or expertise limitations in effectively integrating new technologies—like ChatGPT—into the learning environment. The authors of this paper sought to provide practical recommendations for integrating ChatGPT to enhance student learning and engagement.

### **Literature Review**

#### **Introduction to ChatGPT**

Advancements in AI technology have brought about a range of new tools to support educators and students in their academic endeavors, such as ChatGPT. Introduced by OpenAI on November 30, 2022, ChatGPT represents a significant leap forward in conversational AI technology. ChatGPT utilizes deep learning algorithms to understand and respond to written prompts. Mimicking the function of the human brain, deep learning algorithms employ multiple

layers of artificial neural networks that are trained to ingest data and recognize patterns to produce an output (Gupta, 2018). In ChatGPT, these algorithms allow the program to recognize patterns in large datasets of written text and generate coherent and relevant responses, making it an attractive tool for researchers and others seeking to write essays, talks, and papers. ChatGPT can even identify research gaps and write lines of computer code.

One key feature that sets ChatGPT apart from its competitors is its accessibility. The program only requires a free account, which contrasts with other conversational AI tools with more entry barriers (OpenAI, 2023). As noted by van Dis et al. (2023), this model has demonstrated its effectiveness as a product due to its accessibility, requiring only a free account on the website where it is hosted, which has, in turn, led to more user engagement. When a user inputs a prompt related to the topic they wish to explore, ChatGPT analyzes the user's intent by drawing on the content already generated in response to user queries and feedback from previous users' responses. This enables the model to generate new responses that inform future responses and improve the software over time (Gewirtz, 2023).

Another noteworthy feature of ChatGPT is its ability to comprehend language and engage in conversational exchanges. Users can provide follow-up corrections to ChatGPT, which remembers earlier conversations (OpenAI, 2024). ChatGPT can analyze vast amounts of data from diverse sources on the internet to generate coherent and relevant responses (Adesso, 2023; OpenAI, 2023). In contrast to traditional chatbots, which are programmed to follow a set of rules and can only respond to specific keywords and phrases, ChatGPT can engage in more sophisticated and naturalistic conversations.

Furthermore, ChatGPT has a personalized knowledge base and learning ability, enabling it to generate coherent and relevant responses. This has significantly changed how educators and

students issue or respond to assignments, because ChatGPT can generate responses tailored to the individual user's needs (Harris-Perry, 2023). To use ChatGPT, students and educators can input a question or prompt related to the topic they wish to explore. For example, an educator might ask ChatGPT to provide how to teach critical thinking using aviation education. The model will then generate a response based on its understanding of both the English language and the input data it has received.

The effectiveness of ChatGPT is observed to be considerable in the context of recitation and addressing commonly posed questions. In contrast, assignments that require more creative and unique solutions tend to challenge the model. Educators who predominantly employ simpler or frequently used assignments, such as defining terms or explaining concepts in a student's own words, may be at greater risk of students utilizing ChatGPT as a resource to evade learning or completing work, mainly when dealing with individuals who lack integrity or are apathetic towards course content. Nevertheless, Kelemen et al. (2023) contend that aviation education, which incorporates practical skill evaluation components, presents various instructional challenges. While ChatGPT's accessibility and effectiveness render it a popular tool, users must remain cognizant of its limitations and susceptibility to misuse.

### **ChatGPT for Aviation Education**

As ChatGPT continues to gain popularity in education, it is crucial to address the ethical concerns arising from its use. While transparency, justice, fairness, and privacy are significant considerations, it is essential to consider how ChatGPT can be responsibly used in aviation education. Duckworth and Ungar (2023) suggested that instructors learn to incorporate ChatGPT into curricula. Similarly, Mogali (2023) supported that ChatGPT's conversational nature makes it suitable for providing personalized learning outcomes, particularly in tutoring or one-on-one

environments where traditional education may lack the necessary resources or time to offer additional instruction. One of the current knowledge gaps in aviation education is the lack of trainers and the high workload associated with the lack of trainers (Lazure et al., 2020). ChatGPT and similar programs represent ways to add one-on-one instruction to alleviate this issue. ChatGPT can supplement simple clarifications, individual question and answering sessions, and other exercises.

In aviation education, where individual performance is highly valued to develop didactic pathways for the professional world, ChatGPT could effectively handle tasks such as providing supplemental ground instruction, generating scenarios for simulation, and clarifying difficult-to-understand topics (Keleman et al., 2023; Mogali, 2023). ChatGPT can thus alleviate the pressure on instructors by allowing students to self-direct their own tutoring sessions and explore supplemental material at their leisure, thus allowing for more focused crafting of specific instructor-driven lessons designed to address learning objectives (Lazure et al., 2020).

To effectively instruct students and provide clear pathways for growth, educators should provide clear and specific feedback to their students (Boud & Molloy, 2013). While ChatGPT can assist with tasks by aiding in the composition of personalized responses to student submissions (Harris-Perry, 2023), aviation educators must provide guidance to ensure the accuracy of the information it provides. Educators must instruct students on the correct application of this tool (Mogali, 2023). ChatGPT's conversational nature and accessibility make it an attractive tool for providing personalized learning outcomes, particularly in aviation education, where individual performance is crucial.

## **Bloom's Taxonomy**

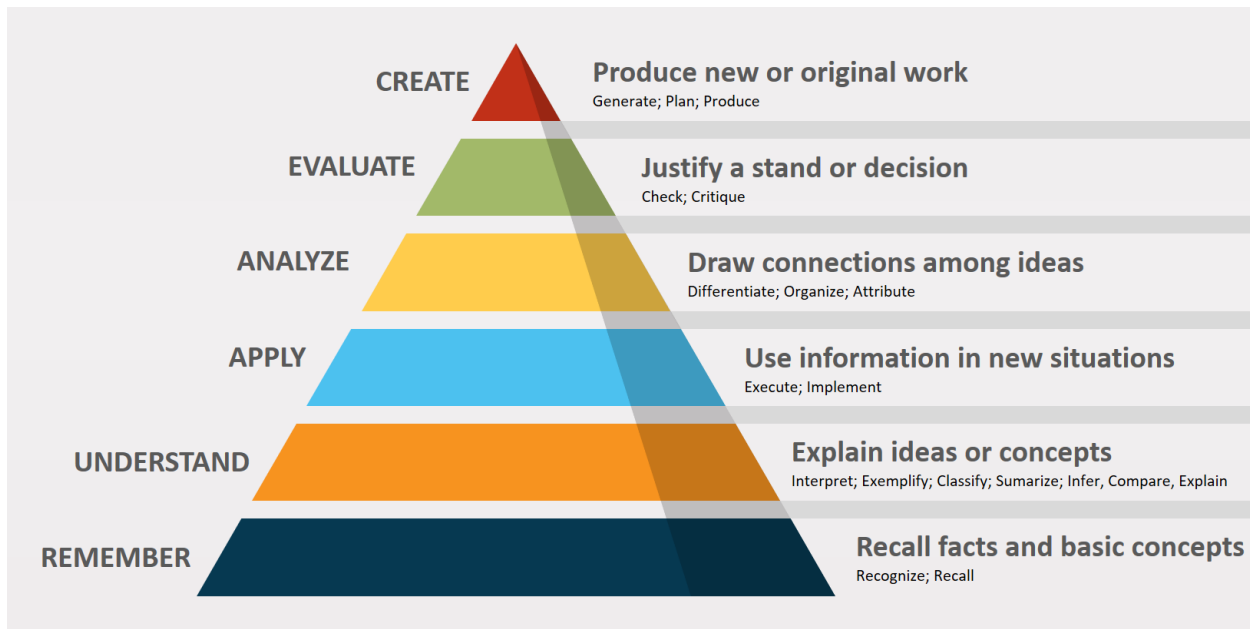
The exploration of ChatGPT's potential applications in aviation education was guided by the framework of Bloom's taxonomy, which provides a structured approach to organizing educational objectives based on cognitive complexity (Krathwohl, 2002). Bloom's taxonomy consists of six stages: remembering, understanding, applying, evaluating, and creating (Gary, 2018; Krathwohl, 2002). Each stage builds upon the previous one, with increasing levels of complexity and critical thinking. Bloom's taxonomy provides a structured framework for assessing effectiveness of ChatGPT across different cognitive levels, ensuring that the study covers a wide range of educational objectives.

ChatGPT can revolutionize aviation education by providing interactive learning experiences that support all stages of Bloom's taxonomy. In the initial stages, such as remembering and understanding, ChatGPT can assist students in recalling and comprehending information (Forehand, 2005). As students progress through the taxonomy, they are encouraged to apply their knowledge, analyze information, evaluate ideas, and ultimately create new concepts (Krathwohl, 2002). This progression enhances and deepens students' knowledge of a particular topic. ChatGPT can provide explanations tailored to students' understanding and learning style, facilitating problem-solving and information analysis at the applying and analyzing stages. Moreover, ChatGPT can aid students in evaluating information and generating new solutions at the evaluating and creating stages. For a visual representation of Bloom's taxonomy, see Figure 1.



**Figure 1**

*Bloom's Taxonomy*



*Note.* Derived from *Unlocking potential: How Teachers Can Use Bloom's Taxonomy Technique to Boost Classroom Productivity* by A. Das, 2023, Faculty Matters

(<https://www.facultymatters.in/post/unlocking-potential-how-teachers-can-use-bloom-s-taxonomy-technique-to-boost-classroom-productivity>). Made with PresentationGO.com.

### **Methodology**

The authors employed an iterative, exploratory research methodology to assess specific applications for the use of ChatGPT in aviation educational settings using Bloom's Taxonomy of Learning Model. The authors sought to identify various methods of utilizing ChatGPT to support student learning and engagement.

The authors utilized ChatGPT to explore and identify various uses and practices for aviation educators and students. The study did not involve human participants. The authors

began by conducting an extensive review of the literature and other media about the general capabilities, applications, and recommendations for using ChatGPT to design and format ChatGPT inquiry prompts appropriately. The authors examined each step and sub-step of Bloom's Taxonomy and identified one or more applications to apply ChatGPT to achieve that learning outcome. Recommended applications and inputs were tested using a live ChatGPT environment to ensure the tool generated outcomes that met established requirements.

This study employed an exploratory research design to investigate the potential applications of ChatGPT in aviation education. Researchers posed prompts and questions related to aviation education to examine the capabilities and potential benefits of the language model. The authors created two distinct types of inquiries for each sub-level of Bloom's Taxonomy: one that provided an immediate answer or response to the student inquiry [referred to as a TELL inquiry] and one that facilitated student engagement or reinforcement of the material through a learning strategy [HELP inquiry]. The authors recognize that there are times when each inquiry type is appropriate—sometimes the student merely requires an explanation of the answer rather than engaging with the material. In contrast, other times, a student would benefit from engagement and reinforcement activities.

### **Undergraduate and Graduate Learning**

The study also considered the differences between undergraduate and graduate learning in aviation education. Undergraduate students typically acquire fundamental knowledge and skills under the guidance of field experts. In contrast, graduate students are expected to become self-directed learners capable of acquiring disciplinary knowledge and skills with minimal guidance. As a result, the role of faculty members shifts from direct instruction to facilitation in graduate education (Sullivan, 1991). Artino and Stephens (2009) supported the idea that graduate

students demonstrate higher levels of critical thinking than undergraduate students. Furthermore, doctoral students engage in original research and scholarship, showcasing an additional level of critical thinking skills (Artino & Stephens, 2009). These characteristics align with the later stages of Bloom's taxonomy, indicating a more holistic understanding of the subject matter.

Bloom's taxonomy provides a practical framework for describing the expectations of student learning outcomes across different academic programs (Das, 2023; Sullivan, 1991). Lower-level or general education courses often focus on basic knowledge acquisition and comprehension, corresponding to the lower stages of Bloom's taxonomy, such as remembering and understanding. Conversely, advanced courses at the graduate level emphasize higher order thinking skills, including analyzing, evaluating, and creating, aligning with the upper stages of Bloom's taxonomy (Das, 2023).

Lower-level or general education courses may prioritize basic knowledge acquisition and comprehension, but this does not necessarily mean higher-order thinking skills are absent (Stanny, 2016). Many introductory courses intentionally incorporate opportunities for critical thinking and problem-solving. Similarly, advanced courses at the graduate level may not always exclusively focus on theoretical analysis but also emphasize practical application and skill development.

### **Data Collection**

The researchers engaged directly with ChatGPT, posing prompts and queries relevant to aviation education topics, such as inquiries about teaching critical thinking skills or providing instruction in the aviation field. For a practical example of such an interaction with ChatGPT, see Appendix A. ChatGPT then generated responses based on its analysis of large datasets and previous user interactions. The researchers evaluated and analyzed these responses to assess the

usefulness and appropriateness of the generated content relative to the aviation topic presented and the Bloom's Taxonomy Level desired. The research questions formulated for the study guided the exploration of ChatGPT's potential applications in aviation education. The authors iteratively examined each step and sub-step of Bloom's taxonomy and identified one or more applications to apply ChatGPT to achieve that desired learning outcome. Inquiry format was informed through a combination of online research about improving ChatGPT inputs, proven ChatGPT capabilities, and ChatGPT application to other fields. The researchers adapted inquiries to support aviation themes.

### **Results**

This study's findings are based on the researchers' interactions and analysis of ChatGPT's responses and the synthesis of relevant literature. The results provide insights and recommendations regarding the potential uses, benefits, and ethical considerations of incorporating ChatGPT in aviation education.

Table 1 provides further insights into how ChatGPT can be utilized across the different levels of Bloom's taxonomy. The study's findings are based on the researchers' interactions and analysis of ChatGPT's responses, as well as the synthesis of relevant literature. The results contribute to understanding how ChatGPT can be effectively employed to support aviation education across the stages of Bloom's taxonomy, catering to the unique needs and expectations of aviation students and faculty.

**Table 1***Cognitive Process Dimension of the Bloom's Taxonomy for Educators*

Stages		Definition	ChatGPT Inquiry [TELL]	ChatGPT Inquiry [HELP]
Remember	Recognize	Identify basic knowledge and facts	“Explain the stages of thunderstorm development based on private pilot exam questions.”	“Present recognition study questions for the private pilot exam on thunderstorms, with four multiple choice answers. Present questions one at a time and do not provide the correct answer until I respond. Evaluate my response against the correct answer.”
	Recall	Retrieve knowledge from memory	“Provide the correct answer(s) after each statement and let me know if I missed anything. The major parts of an airplane are the empennage, wings, landing gear, and cowling.”	“Present recall study questions (fill in the blank) for the private pilot exam on aircraft performance. Present questions one at a time and do not provide the correct answer until I respond. Evaluate my response against the correct answer.”
Understand	Interpret	Interpret information	“Interpret the following METAR report: [METAR report data].”	“Present a METAR report with several interpretation (fill in the blank) questions. Present questions one at a time and do not provide the correct answer until I respond. Evaluate my response against the correct answer.”
	Exemplify	Provide examples of concepts	“Describe how aircraft maneuvers affect the generation of lift, based on Bernoulli's principle.”	“Provide an aviation scenario and ask open-ended, short-answer questions regarding Bernoulli's principle. Present questions one at a time and do not provide the correct answer until I respond. Evaluate my response against the correct answer.”
	Classify	Categorize information	“What is the difference between a regional and national airline?” “What category of airline would Southwest Airlines be? Why?”	“Regarding airline categories, present the name of a random airline and ask what category of airline it belongs. Present questions one at a time and do not provide the correct answer until I respond. Evaluate my response against the correct answer.”
	Summarize	Condense information	“Provide a one paragraph summary of the following text: [pasted TEXT]”	“Ask me comprehension or summary questions about the following text. Present questions one at a time and do not provide the correct answer until I respond. [pasted TEXT]” “I will input an abstract at the end of this inquiry. Ask me to "Summarize the abstract." Do not provide the correct answer until I respond. Evaluate the accuracy of my response. Abstract: [ABSTRACT]”
	Infer	Draw conclusions from info	“Given a set of METAR weather conditions, infer the potential effects on aviation operations at the airport: [METAR data]”	“Given the following METAR data: [METAR data], ask me open-ended inference questions. Do not provide the correct answer until I respond. Evaluate the accuracy of my response.”

	Compare	Identify similarities and differences	“Compare and contrast the crew resource management issues involved in the United Airlines Flight 173 and Eastern Flight 401 accidents.”	“Recommend case studies that involve a loss of control.”
	Explain	Provide explanation	“Explain how the [PROCESS or CONCEPT] works” “Provide additional details about [SUB-PROCESS or SUB-CONCEPT]” “Provide an alternative explanation about [PROCESS or CONCEPT]”	“Evaluate the following explanation of [PROCESS or CONCEPT]: [Short-answer explanation]”
Apply	Execute	Apply knowledge to solve problems	“Given [PROBLEM EXPLANATION] suggest possible solutions. Identify benefits and risks of each potential solution.” “Adjust recommendations, given the following additional scenario details: [DETAILS].”	“Provide a scenario-based question based on what can go wrong with the [PROCESS/CONCEPT], but do not provide the correct answer until I respond. Evaluate my response against the correct answer.”
	Implement	Taking idea into action	“How would an organization go about implementing a Safety Management System?”	“What challenges or problems need to be addressed when attempting to implement a Safety Management System into an organization?”
Analyze	Differentiate	Recognizing differences between concepts	“Generate a scenario involving aircraft navigation. Explain and differences and relationship between true course, true heading, magnetic heading, magnetic variation, wind correction angle, and compass heading. Calculate how each value is affected, based on a known value.”	“Generate a scenario with inductive and deductive calculation questions for the concepts of true course, true heading, magnetic heading, magnetic variation, wind correction angle, and compass heading. Provide questions one at a time and do not provide the response until I answer. Evaluate each of my responses.”
	Organize	Arranging ideas in a logical order	“Explain how an aircraft emergency should be handled, based on the categories of aviate, navigate, communicate. Apply this process to generate an emergency flight scenario, with steps and identify how each step can be categorized.” “Describe the order of steps involved in a pilot communicating with air traffic control using a radio.”	“Generate a scenario based on an aircraft emergency. Provide four response options for each question. Present questions one at a time and do not give me the answer. After I respond, evaluate my responses to select the most appropriate action based on the priorities of: aviate, navigate, communicate.”
	Attribute	Identifying the sources of ideas	“How do I cite the FAA Airplane Flying Handbook in APA?”	“Review the following sources. Identify the proportion of sources that are primary, secondary, or tertiary.”
Evaluate	Check	Evaluating quality or accuracy of ideas from multiple sources	“Compare and contrast two descriptions of Crew Resource Management. Identify inaccuracies based on available information. Description #1: [DESCRIPTION] Description #2: [DESCRIPTION]”	“Create a concept map of Crew Resource Management Topics.” “Recommend debate topics on Crew Resource Management. Ensure that all topics have two possible opinion-based sides for debate.”

	Critique	Evaluating strengths and weaknesses of ideas	“Identify strengths and weaknesses of an airline using a single aircraft type.”	“Provide a recommended rubric for evaluating quantitative research articles.” “Evaluate the following article for logical fallacies.”
Create	Generate	Creating new ideas	“Identify potential gaps in literature on the aviation topic of [TOPIC AREA].” “Identify existing challenges in the field of aviation with an emphasis on [TOPIC AREA].”	“Suggest methods for brainstorming new ideas about [TOPIC].” “Recommend methods for evaluating if a new idea about [TOPIC] is viable.”
	Plan	Developing strategy/plan of action	“Develop a plan of action for snow removal at a new general aviation airport.”	“Given the following key points, develop a logical outline for a presentation on airport operations: [KEY POINTS]”
	Produce	Creating a final product or output	“Improve the following essay: [ESSAY].”	“Provide feedback and improvement suggestions for the following essay: [ESSAY].” “Recommend ways to strengthen the thesis and supporting material in the following essay: [ESSAY].” “Identify strengths and weaknesses in the following essay: [ESSAY].” “Provide a critique of the following essay based on the following factors: information synthesis, proper grammar, correct spelling, accurate punctuation, use of active voice, correct tone, and use of appropriate transitions. Essay: [ESSAY].”

## Educational Use Cases

The emergence of AI has created new opportunities in education. ChatGPT can be used in education and support students’ cognitive development, as conceptualized through Bloom’s taxonomy. ChatGPT can facilitate the remembering and understanding of the different levels of Bloom’s taxonomy by providing definitions, summaries, and answering factual questions. This support is especially helpful for students who need extra assistance or may have missed classes (see Appendix A for an example of this type of usage). Perhaps most useful is ChatGPT’s ability to adapt to the learning level of the student. ChatGPT is equally adept at reinforcing lower-level memorization or comprehension tasks as it supports higher-order learning tasks.

As student learning progresses up the taxonomy, ChatGPT can also support the development of higher order thinking skills such as applying, analyzing, and evaluating. For instance, ChatGPT can help students apply concepts to real-world situations, analyze complex problems by breaking them down into smaller parts, and evaluate the quality of different arguments. It can allow students to engage in critical thinking and problem-solving, which are essential skills for success in education (Abramson, 2023). In addition to supporting cognitive development, ChatGPT can help students with their project ideas and provide initial feedback. This type of support can save time and effort, as ChatGPT can provide quick and accurate feedback, enabling students to focus on the more critical aspects of their projects.

### **Limitations of ChatGPT**

Using ChatGPT or language models (LM) in aviation education presents advantages and disadvantages. While LMs offer researchers and students a new tool to generate data on specific subjects, it is important to acknowledge the potential risks and limitations associated with their use (Stahl, 2021). One of the main concerns raised by influential AI researchers is the tendency of LMs to be misleading and inaccurate. LMs, like ChatGPT, are designed to stitch together sequences of linguistic forms based on training data without necessarily understanding the underlying meaning (Bender et al., 2021). This phenomenon, known as the stochastic parrot, highlights the risk of misinterpreting the data encoded in LMs, as they may reflect various worldviews on a topic rather than true language understanding.

Another important caveat is the potential for LMs to be “directionally right but specifically off” (Turban, 2023, para. 11). While LMs can provide general information, they are susceptible to making errors or misinterpretations regarding specific details. Researchers need to exercise caution when relying on the outputs of ChatGPT, as demonstrated by cases where it has



provided incorrect data or referenced nonexistent resources. Determining the boundary between AI-generated content and author contribution is another challenge. Educators and students must carefully assess when data provided by AI should be considered plagiarism and how to measure its contribution in comparison to the original work.

Hallucinations in AI findings are another concern. As described by Stephen Turban (2023), “they are creative, interesting, even captivating, but the final 1 – 2% of producing highly accurate summaries that stand up to deep scrutiny is not quite there” (para. 14). Educators and students should be mindful of this limitation, particularly when using LMs for highly accurate summaries or critical analysis. Errors in providing references are also prevalent in AI-generated content. Instances where ChatGPT provides nonexistent or incorrect references have been reported (Sallam, 2023). Educators and students should be cautious when relying on AI for reference material and should verify the accuracy and validity of the provided sources.

Despite these limitations, LMs can be valuable educational tools, providing additional data, enhancing knowledge, and expediting the research process. AI technology, including LMs, can stimulate out-of-the-box thinking and foster creativity. Educators and students must exercise caution, confirm the accuracy of AI-generated data, and be mindful of plagiarism issues when incorporating LMs like ChatGPT into their work. Technology is continually evolving, and, while it may not yet be fully reliable for certain research tasks, it can contribute to various aspects of research with appropriate verification and oversight.

ChatGPT is a valuable tool for educators and students, supporting various levels of Bloom's taxonomy and facilitating complex cognitive processes. It can also assist students with their project ideas, saving time and effort. To ensure ethical usage, faculty should adopt transparency by clearly defining the conditions for LM usage and communicating them through

the syllabus and announcements. Educators must provide students with comprehensive information about this technology, its capabilities, and limitations, and how it can enhance their learning. This approach enables students to understand how their work is evaluated and the extent to which ChatGPT is involved in the assessment process. Simultaneously, students should also uphold transparency by openly acknowledging their use of ChatGPT.

### **Conclusions**

The researchers used the results to answer the research questions. This exploratory research was able to generate directions for further study and provide ways for educators to explore the new technology themselves.

#### **How can ChatGPT be used by students to support learning at each stage of Bloom's Taxonomy?**

ChatGPT can provide definitions, summaries, and factual answers in the initial stages of remembering and understanding. Moving on to the applying stage, it assists students in real-world applications of their knowledge. ChatGPT helps break down complex aviation concepts for detailed examination in the analyzing stage. For the evaluating stage, ChatGPT can aid students in assessing information and arguments, while in the creating stage, ChatGPT fosters creative thinking and idea generation.

#### **How can teachers use ChatGPT to enhance student engagement in the learning process at each stage of Bloom's Taxonomy?**

Teachers can leverage ChatGPT to enhance student engagement across all levels of Bloom's Taxonomy. Educators can use ChatGPT to help students recognize and retrieve fundamental knowledge in the remembering and understanding stage. As students progress to applying their knowledge, ChatGPT can assist in problem-solving. When students analyze and

organize information, teachers can employ ChatGPT to facilitate differentiation and logical arrangement of ideas. In the evaluating and critiquing stage, educators can use ChatGPT to facilitate idea evaluation and identify strengths and weaknesses. Finally, in the creating and producing stage, teachers can provide feedback and improvement suggestions for student essays, enhancing their writing and critical thinking skills.

### **What are the potential risks related to using ChatGPT as an educational resource?**

Using ChatGPT as an educational resource does come with potential risks. Misleading and inaccurate information may arise due to the stochastic parrot phenomenon, where LMs like ChatGPT stitch together linguistic forms without true comprehension. This risk of misinterpreting data encoded in LMs can reflect biased worldviews rather than genuine understanding. Determining the boundary between AI-generated content and student contribution poses challenges, and plagiarism issues must be cautiously addressed. Hallucinations in AI findings and errors in providing references are additional concerns. Hence, educators and students must exercise caution, verify AI-generated data, and prioritize transparency in using ChatGPT ethically. The importance of information validation is *particularly important* in aviation, where inaccurate information can put lives at risk. While ChatGPT is a powerful tool for learning, the importance of proper response information vetting cannot be understated. Instructors should take steps to not only provide validation and correct inaccurate ChatGPT responses while in the classroom, but also teach students who use ChatGPT independently how to verify response information is valid and reliable.

## **What student guidelines or policies should be in place regarding the use of ChatGPT for learning?**

The authors provided guidance and policies regarding the use of ChatGPT in education. Instructors are encouraged to recognize that ChatGPT is a tool, and its appropriateness depends on its context of use. They should adapt their assessment strategies to account for its presence, ensuring a fair evaluation for all students. Leveraging ChatGPT to enhance learning is crucial, focusing on its potential to improve students' understanding and interaction with the material. While instructors should generally permit its use, they should also define boundaries and restrictions when appropriate to maintain assignment integrity. By adhering to these guidelines, educators can harness the benefits of ChatGPT while fostering a responsible and supportive educational experience.

The emergence of ChatGPT as a powerful language model developed by OpenAI can potentially revolutionize aviation education by providing scalable and personalized instruction. This paper explored the potential applications of ChatGPT in enhancing student engagement and critical thinking in college classrooms, as well as the ethical concerns associated with its use as an educational resource. By analyzing the capabilities and limitations of ChatGPT and synthesizing relevant literature, this study has provided aviation educators with valuable insights and recommendations.

The findings of this study demonstrated that ChatGPT could effectively support aviation education across the stages of Bloom's taxonomy, from remembering and understanding to applying, evaluating, and creating. By leveraging the personalized knowledge base and learning ability of ChatGPT, educators can provide tailored explanations and guidance to students, fostering problem-solving skills and information analysis. Additionally, ChatGPT's

conversational nature and accessibility make it a valuable tool for providing personalized learning outcomes, particularly in one-on-one environments and in aviation education, where individual performance is crucial.

Educators must remain mindful of the limitations and susceptibility to misuse of ChatGPT. While it can enhance instructional outcomes, efforts should be made to ensure that ChatGPT provides accurate information and that students use the tool appropriately. Faculty members should provide clear guidance and specific feedback to ensure the responsible use of ChatGPT in aviation education.

Incorporating ChatGPT into aviation education can enhance student engagement, critical thinking, and overall learning experiences. By embracing this technology effectively and implementing appropriate policies, aviation educators can leverage the power of AI to improve instructional outcomes and better prepare students for the professional world. It is essential to continue exploring and researching the potential applications and ethical considerations of ChatGPT in aviation education to maximize its benefits and address any concerns that may arise.

### **Recommended Guidance & Policies Regarding Educational Use of ChatGPT**

The authors offer the following guidance regarding the routine use of chatbots in learning settings based on the results viewed through the lens of attempting to guide students into higher levels of Bloom's Taxonomy:

- **Instructors Should Expect Students Will Use ChatGPT:** ChatGPT is merely a tool—just like spell checking, Grammarly, Google, Word Processing Software, and other computer-based resources. It is not inherently good or bad as a resource, but like any tool, its appropriateness depends on the context of its use.

- **Instructors Should Adapt Their Assessment Style to Account for ChatGPT:** While some students will use ChatGPT as a resource for completing assignments—particularly essays or writing assignments—others may not. Instructors should be prepared to adapt their assessment strategy to account for the tool’s use. For example, if a grading rubric assesses grammar and spelling, a student who did not use ChatGPT might be permitted to make more mistakes than a student who did use the resource.
- **Instructor’s Responsibility for Leveraging ChatGPT to Enhance Learning:** When determining if ChatGPT should be made available for teaching or assignments, instructors should determine if its use will *enhance* or *detract* from student learning. Learning enhancement generally means that a student will experience an improvement in learning, by learning material faster or better than the norm. Another metric for assessing learning enhancement is determining if the use of ChatGPT will allow students to increase their knowledge of learned material by interacting with it at *higher levels of Bloom’s Taxonomy*.
- **Instructor’s Responsibility to Determine Appropriateness of Restricting ChatGPT:** Generally, instructors should permit the use of ChatGPT *unless there are valid reasons for its restriction*. Instructors should clearly communicate which activities or assignments are restricted from the use of ChatGPT *and* provide the rationale for their them.

Instructors should also ensure that students do not exhibit *overreliance* on ChatGPT to the detriment of learning, critical thinking, and engagement. Instructors should appropriately throttle ChatGPT usage to ensure it is treated as a *learning resource* but does not develop into a *learning crutch* for students.

Instructors should recognize that some learning tasks are foundational. ChatGPT should not be used during these tasks. Primary writing, for example, should not be undertaken by ChatGPT, as it robs the student of creative thinking and application of learned material. ChatGPT should be limited to augmenting and improving student work in these cases.

- **Instructor’s Responsibility for Upholding Integrity of Restricted Learning**

**Activities:** Instructors should make reasonable efforts to maintain assignment integrity when ChatGPT is restricted. This may include in-class supervised writing assignments, quizzes, LockDown browser protections, use of AI-detection tools, or other learning activities or strategies that the instructor can use to verify that ChatGPT could not be used.

- **Instructor’s Responsibility for Demonstrating Appropriate Use of ChatGPT:**

Instructors must demonstrate and emulate how ChatGPT should be used appropriately, both inside and outside the classroom. Instructors should openly and candidly discuss ChatGPT's capabilities and limitations as a learning resource.

- **Student’s Responsibility for Acknowledging the Use of ChatGPT:** Students need to understand and appropriately identify and acknowledge when ideas are not their own. Students should be taught the difference between original work and plagiarism and how to acknowledge the ideas of others appropriately. The use of ChatGPT should be acknowledged and identified, where appropriate.. Acknowledgment can be as simple as requiring students to identify how ChatGPT was used in an assignment, such as “original paper edited using ChatGPT” or “ChatGPT used to organize original ideas.”

- **Student’s Responsibility for Fact Checking ChatGPT-Generated Content:**

Instructors should reinforce the student’s need to verify ChatGPT-generated content using primary source material and ensure such material is appropriately cited. This guidance protects against unquestioning acceptance of potentially incorrect information. Instructors should aid students in this endeavor by levying additional scrutiny on ChatGPT-generated content and ensuring students provide adequate support material to back up ChatGPT-generated content.

- **Instructor’s Responsibility to Ensure Reasonable Student Accessibility:** Instructors must ensure a fair playing field for student success. Instructors have a duty to ensure that all students in the classroom have *reasonable and equitable* accessibility to generative AI resources if the instructor intends to permit their use. Ethically, each student should be afforded access to the same resources as another. This is like the allowance of a calculator in a math class. The advantages and resources afforded to one student should apply to all.

### **A Recommended Model for ChatGPT Use in the Classroom**

Based on the findings of this study, the authors recommend implementation of ChatGPT in the classroom as a supplement to the primary instructor, *but under close supervision*. The authors recommend ChatGPT be displayed on a monitor or other visible display available to students; however, the authors do not recommend students are given unmonitored access to submit inquiries. It is recommended that a knowledgeable teaching assistant set up a chat program that enables students to submit requested inquiries. The teaching assistant would be responsible for inputting the inquiry into ChatGPT and vetting the response. This approach also enables the primary instructor to monitor ChatGPT inquiries and responses to gauge student



understanding of presented material. The primary instructor should adjust instruction based on trending inquiries presented to ChatGPT. Additionally, the instructor may elect to provide additional clarification or caveats to ChatGPT responses, as appropriate.

### **Recommendations for Future Research**

Future research should empirically test the validity and reliability of LMs like ChatGPT in diverse educational settings, comparing their outputs with traditional resources and human expertise. Additionally, investigating the impact of ChatGPT on students' critical thinking and learning outcomes would be crucial. Ethical considerations should also be explored, such as addressing plagiarism and developing guidelines for responsible AI usage. Understanding the most effective integration of ChatGPT into classrooms and staying current with AI advancements will ensure educators and students can harness its full potential as a valuable educational tool.

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## Appendix A

### METAR Review Exercise via ChatGPT

Q) Can you make an example METAR with review questions?

A) Certainly! Here's an example METAR (Meteorological Aerodrome Report) with review questions:

METAR Example:

METAR EGLL 121500Z 18010KT 9999 SCT025 14/09 Q1015 NOSIG

Review Questions:

What is the ICAO code for the reporting station?

What is the date and time of the observation?

What is the wind direction and speed?

What is the horizontal visibility?

What is the cloud cover and altitude?

What is the temperature and dew point?

What is the atmospheric pressure?

Is there any significant weather?

What does "NOSIG" at the end of the METAR indicate?

Answers:

The ICAO code for the reporting station is EGLL, which represents London Heathrow Airport.

The date and time of the observation is the 12th day of the month at 1500 UTC.

The wind is blowing from the south (180 degrees) at a speed of 10 knots.

The horizontal visibility is 9999 meters, indicating good visibility.

The cloud cover is scattered (SCT) at an altitude of 2500 feet (SCT025).

The temperature is 14 degrees Celsius, and the dew point is 9 degrees Celsius.

The atmospheric pressure is 1015 hectopascals (hPa).

The "NOSIG" indicates no significant weather, meaning there are no significant changes expected in weather conditions.

"NOSIG" stands for "No Significant Change," which means no significant changes are expected in weather conditions for the next two hours.

Q) What kind of sources shall I use to study METAR reports and their impact on aviation operations?

A) For a study involving METAR reports and their impact on aviation operations, you may want to consider using a combination of primary and secondary sources. Here are some examples of potential sources to consider:

1. METAR reports: The primary source of data for your study will likely be the METAR reports themselves. You can obtain METAR data from the National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Hourly Data Set and Aviation Digital Data Service.

2. Academic literature: You can review relevant academic literature to gather background information on METARs and their use in aviation. Some useful databases for finding academic articles include Google Scholar, JSTOR, and Scopus.

3. Industry publications: Industry publications such as Aviation Week and FlightGlobal may provide insights into how METARs are used in aviation operations and any trends or issues related to their use.

4. Interviews: Conducting interviews with pilots and aviation personnel can provide valuable insights into how METARs are used and interpreted in practice. You may also consider interviewing meteorologists or other weather experts to gain a better understanding of how weather events impact the information contained in METAR reports.

5. Government reports: Government reports from agencies such as the Federal Aviation Administration (FAA) or the National Transportation Safety Board (NTSB) may provide information on incidents or accidents related to weather events and the use of METAR reports.



6. Online forums and social media: Online forums and social media groups related to aviation may provide insights into how pilots and aviation personnel use and interpret METAR reports in practice.

When selecting sources, be sure to evaluate them for credibility and relevance to your research question.