Program-Level Assessment: Annual Report

Program Name (no acronyms): Ph.D. in Aviation	Department: Oliver L. Parks Department of Aviation Science
Degree or Certificate Level: Doctor of Philosophy	College/School: School of Science and Engineering
Date (Month/Year): June 2022	Assessment Contact: Stephen G. Magoc

In what year was the data upon which this report is based collected? AY Fall 2021 – Spring 2022

In what year was the program's assessment plan most recently reviewed/updated? June 2022

Is this program accredited by an external program/disciplinary/specialized accrediting organization? No

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please list the full, complete learning outcome statements and not just numbers, e.g., Outcomes 1 and 2.)

Student Learning Outcome # 1 - Assess relevant literature or scholarly contributions in the aviation field of study.

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe the artifacts in detail and identify the course(s) in which they were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

Evidence from courses include, but are not limited to, assignments, quizzes, papers, and student surveys are collected by the department. All courses were taught in an online modality. The courses from which evidence was collected are:

ASCI 5010 Introduction to Aviation Research Methods
ASCI 5020 Analysis of Aviation Safety Data
ASCI 5030 Aviation Security Management
ASCI 5220 Aviation Safety Programs
ASCI 5470 Quantitative Data Analysis
ASCI 6010 Federal and International Regulations

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and **include them in/with this report document** (please do not just refer to the assessment plan).

The faculty of the Department of Aviation Science met to assess the student learning outcome. Performance indicator rubrics prepared by the faculty were used to determine if graduates were able to meet the requirements of the student learning outcome being assessed. The rubric used to determine if graduates met the student learning outcome, and the course performance indicator rubrics used in this assessment are found in Appendix A of this assessment report.

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

The result of the assessment of the student learning outcome is that the graduates do meet the student learning outcome requirements. These courses were taught only in an online modality so there is no difference in achievement to note.

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

The data tells the faculty of the department that its graduates currently have the ability to assess relevant literature or scholarly contributions in the aviation field of study.

6. Closing the Loop: Dissemination and Use of <u>Current</u> Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

All faculty in the department met on 06/23/2022 to assess the student learning outcome, therefore all faculty are aware of the results and findings of this assessment cycle.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

The faculty agreed to take certain actions/make changes to course content so as to better enable students to perform at higher level when working to achievement of the requirements of the student learning outcome. These changes are as follows:

Course	Action Item
ASCI 5010 Introduction to Aviation Research Methods	Raise level of rigor in the course by requiring a term paper
ASCI 5030 Aviation Security Management	Require students to use contemporary resources (or seminal work) for precis assignments

		Students will articulate strengths and weaknesses in discussion boards posts critiquing classmates' observations.	
	ASCI 5470 Quantitative Data Analysis	Improve learner-learner interaction.	
		Improve learner-learner interaction.	

If no changes are being made, please explain why.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

Faculty of the department developed more-explicit instructions for discussion board accountability.

B. How has this change/have these changes been assessed?

The faculty of the department discussed the effect of the more-explicit instructions for the discussion boards as used in the graduate courses.

C. What were the findings of the assessment?

The faculty of the department determined that due to the more-explicit discussion board instructions, the students were better able to complete assignments and interact with fellow students more efficiently.

D. How do you plan to (continue to) use this information moving forward?

The department faculty will continue to monitor the discussion boards in the courses to ensure that the students understand and follow the more-explicit instructions provided.

IMPORTANT: Please submit any assessment tools (e.g., artifact prompts, rubrics) with this report as separate attachments or copied and pasted into this Word document. Please do not just refer to the assessment plan; the report should serve as a stand-alone document.

Department of Aviation Science

Ph.D. in Aviation

Assessment of Graduate Student Learning Outcomes

Student Learning Outcome #1: Assess relevant literature or scholarly contributions in the aviation field of study.

Date of this assessment: 06-23-2022

The following assessment is based on prior coursework of graduates and surveys of graduates.

Performance Indicator Assessed	Does not Meet	Meets
Graduates identify notable research groups and investigators. Student can demonstrate broad knowledge of areas outside of their sub-specialty, and specific knowledge of publications in their field.		X
Graduates analyze the current key issues and highly cited papers in the aviation field and synthesize with emerging trends and new research directions.		X
Graduates identify important historical contributions in the aviation field and outline their importance.		X

List any prior change(s) made to the curriculum to aid students and graduates in meeting this student learning outcome: Faculty of the department developed more-explicit instructions for discussion board accountability.

Describe the effect of any change(s) made to the curriculum: The faculty of the department determined that due to the more-explicit discussion board instructions, the students were better able to complete assignments and interact with fellow students more efficiently.

List recommendation(s) for changes to be made to the curriculum as a result of this assessment: See the following table.

Department of Aviation Science

Ph.D. in Aviation Graduate Program Assessment

Continuous Improvement Items

06-23-2022

Course	Student Learning Outcome	Action Item
ASCI 5010 Introduction to Aviation Research Methods	SLO 1 – Assess relevant literature or scholarly contributions in the aviation field of study.	Raise level of rigor by requiring a term paper
ASCI 5030 Aviation Security Management	SLO 1 – Assess relevant literature or scholarly contributions in the aviation field of study.	Require students to use contemporary resources (or seminal work) for precis assignments
		Articulate strengths and weaknesses in discussion boards posts critiquing classmates' observations.
ASCI 5470 Quantitative Data Analysis	SLO 1 – Assess relevant literature or scholarly contributions in the aviation field of study.	Improve learner-learner interaction.

SAINT LOUIS UNIVERSITY

OLIVER L. PARKS DEPARTMENT
OF AVIATION SCIENCE

Appendix A
Ph.D. in Aviation Program
Course Evidence

Graduate Course Performance Indicator Rubric

Assess Student Learning Outcomes

Course: ASCI 5010 Introduction to Aviation Research Methods Course Instructor: Terrence Kelly

Semester Taught: Fall 2021 Number of Students in Course: 3

Student Learning Outcome Assessed	**Assessment Results:** **(Indicate what % of class achieved a minimum score of 80%)**	**Benchmark achieved?** **(Benchmark: 80% of students will score a minimum of 80% = "B")**
SLO 1: Assess relevant literature or scholarly contributions to the aviation field of study.	Precis Average Scores Precis LM2: 91.0% Precis LM4: 95.6% Precis LM6: 89.3% Precis LM8: 90.0%	Yes, 3 of 3 – 100%
SLO 2: Apply the major practices, theories, or research methodologies in the aviation field of study.	Assignment Average Scores Thesis Statement: 95% Problem Statement: 92% Source List: 100% Mini-Lit Review: 90% Research Questions: 93%	Yes, 3 of 3 – 100%

Course Assessment (Intended Use of Results)The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

SLO 1 was evaluated using precis assignments that required students to assess the literature surrounding an assignment-specific research topic and prepare an overview/critique (precis). Four precis assignments were given over the Fall 2021 semester. The average for precis LM2 was 91%; the average for precis LM4 was 95%; the average for precis LM6 was 89% and the average for precis LM8 was 90%. I do not anticipate a need for any significant changes to achieve SLO 1.

SLO 2 was evaluated using a synthesis of assignments aimed at providing the student a better understanding of how to engage in research methodologies surrounding the field of aviation. Throughout the semester, students were required to assemble a) a thesis statement; b) a problem statement; c) a source list; d) a mini literature review with a focus on methodology, and e) research questions in the students' research interest area. Overall, the scores on the assignments were quite strong and suggested the students were developing the research skills necessary for an introductory-research level course. Scores for the aggregate assignments were a) thesis statement 95%, b) problem statement 92%, c) source list 100%, d) mini literature review (methodology argument) 90%, and, d) research questions 93%. While I am pleased with the grades, I do question my own grading. I plan to raise the level of rigor associated with these assignments and will consider adding a more comprehensive writing assignment toward the end of the course that synthesizes all of these skills into a single effort (paper).

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Precis LM6

Introduction

This article presents the ethical considerations and their applications to research, emphasizing the importance of ethical research. This paper was prepared by S. Akaranga & B. Makau from university of Nairobi. In the paper, they describe the definition of ethics and research ethics.

Akaranga & Makau narrates the origin of research ethics based on biomedical research, which evolved from the need to use human people in research, and the origin can be traced back to before the eighteenth century (Akaranga & Makau, 2016). The significant improvement in the research ethics was when an American tribunal launched criminal prosecutions against 23 top German doctors and officials who committed war crimes against humanity in 1946 (Akaranga & Makau, 2016). They were accused of conducting medical tests on hundreds of people held hostage in concentration camps during World War II without their consent (Akaranga & Makau, 2016). Unfortunately, many of the victims died due to the experiments, while others were severely disabled. Because human beings were being exploited in numerous circumstances, the Nuremberg Code was established in 1948 as a result of the trial's findings (Akaranga & Makau, 2016). The Authors present two types of research ethics theories: the bad apple theory and the stressful or imperfect environment theory. They narrate the ethical research issues & ethical issues related to research. Akaranga & Makau list several unethical issues that damage the study's ultimate goals, such as fabrication, falsification, fraud, financial matters, sponsorship issues, plagiarism, writing, and publishing ethics (Akaranga & Makau, 2016). In addition to ethical issues related to research subjects, anonymity, confidentiality, privacy, beneficence, deception, non-maleficence, voluntary issues, informed consent, vulnerable groups issues, and research process issues (Akaranga & Makau, 2016). The authors conclude the paper with recommendations emphasizing the importance of ethics in research to enhance ethical research. **Background Summary**

The authors cite the ethical considerations and their applications to research. They describe the meaning of ethics and research ethics as a discipline of philosophy that deals with human conduct and directs people's norms or standards of behavior and interpersonal relationships, while they describe research ethics as a branch of applied ethics with well-defined principles and guidelines that define how research should be conducted morally and honestly (Akaranga & Makau, 2016). Akaranga & Makau point out that while conducting research, a researcher must observe suitable values at all phases, and it is possible that if this is not observed, scientific misconduct will occur (Akaranga & Makau, 2016).

The authors highlighted some ethical considerations:

1. Fabrication and falsification or fraud: Fabrication entails creating, inventing, or making up false data or results that are then recorded or reported, whereas falsification or fraud entails manipulating materials, equipment, or

processes to change outcomes or omit some data or findings so that the research is not well-represented or recorded (Akaranga & Makau, 2016).

2. Financial & sponsorship issues: The research findings could be jeopardized if the funding organization does not entirely support the research financially and instead focuses on cost- cutting, lowering the study's quality (Akaranga & Makau, 2016).
3. Plagiarism: is most common in the initial pages, such as the introduction and literature review; this can be attributed to laziness, ignorance, or cultural diversity, which may compromise the researcher's honesty (Akaranga & Makau, 2016).
4. Writing & publication ethics: It is unethical to submit the same paper to two distinct journals or publish research findings twice without alerting the editors of the other publication (Akaranga & Makau, 2016).
5. Ethical issues related to research subjects: Human subjects are involved in the majority of research studies, which is why careful consideration must be given to how to interact with and relate to them in this noble endeavor (Akaranga & Makau, 2016).
6. Anonymity, confidentiality, and privacy: During the study, a researcher must protect the respondent's confidential information, but if any information must be shared, the respondent's consent must be obtained; this improves the research subject's honesty by shielding them from bodily and psychological harm (Akaranga & Makau, 2016).
7. Deception: Researchers should be honest with their participants, but if they are only told part of the truth or if the fact is wholly denied or compromised, this can lead to deception (Akaranga & Makau, 2016).
8. Non-maleficence: is a notion that focuses on avoiding harm; it emphasizes the need to prevent any intentional injury or minimize any aspect of potential harm to the respondent by refraining from damaging them physically or psychologically (Akaranga & Makau, 2016).
9. Voluntary and informed consent: is one of the most important ethical dilemmas in research, implying that "a person gives his or her consent willingly, voluntarily, intelligently, and clearly and manifestly (Akaranga & Makau, 2016). A researcher should describe the study's goal in detail, and if there are any dangers associated, they should be explained, and the researcher should not expose the respondent's identity (Akaranga & Makau, 2016).
10. Ethical issues related to the research process: researchers should adhere to guidelines associated with authorship, copyright and patenting policies, data sharing policies, and confidentiality rules in peer review (Akaranga & Makau, 2016).

The authors concluded their paper with several reasons why research ethics are important:

First, they promote the research's main aims, including the acquisition of knowledge, promoting the truth in research by avoiding errors that could arise due to providing false information, fabricating or misrepresenting information (Akaranga & Makau, 2016). Second, it is critical that researchers and consumers trust one another, accept their opinions, and treat one another appropriately. There are guidelines created in this regard to maintain the copyright and patenting policies of their products. However, this can only be accomplished if relevant standards for enha5ncing confidentiality are followed (Akaranga & Makau, 2016). Third, any research that researchers are involved in and any work that is published must be read by the general public, who appreciate the researcher's efforts (Akaranga & Makau, 2016). Fourth**,** if public funds are being used to fund the research, it must be properly accounted for because it must be encouraged to improve its quality and integrity (Akaranga & Makau, 2016). Finally, research ethics is concerned with societal values; as a result, researchers should promote social responsibility, uphold human values, and safeguard the welfare of study participants and animals in accordance with international law and safety regulations (Akaranga & Makau, 2016).

Evaluation

This paper is easy to read and understand since they discuss the common ethical issues related to research in the academic field. In addition to the purely academic ethical issues such as writing and publishing, they addressed the welfare study of the participants, either humankind or animals. The authors do an excellent work narrating the definitions related to the ethics and ethical issues related to the research so the reader can understand the terms. Also, they do a great effort to provide the origin of the research ethics, giving the reader the perfect background. The authors report ethical research issues in this paper include the most common ethical research issues, especially when they included the negative impact of each one. The only drawback that they narrate one of the reasons for the paper is to promote the ranking of their university.

I believe that avoiding ethical research issues is noble work, and ethical research issues must be avoided, not just for college ranking purposes. Overall, this was a well-written paper, especially in the latter section of the paper when the authors concluded their article with several reasons explaining why research ethics are important.

References

Akaranga, S. I., & Makau, B. K. (2016). *Journal of Educational Policy and Entrepreneurial Research*. Retrieved from https://www.semanticscholar.org/paper/Ethical-considerations- and-their-applications-to-a-Akaranga Makau/0aa01e9f5bf5cea523daf16693cfb9dde7096802.

Precis LM8

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Introduction

While it seems fairly intuitive that ethical research seems like the best way to accomplish research, exactly how this is accomplished, to what degree, and against what standard it is measured is not quite as clear. This précis reviews an article that is published in an attempt to help standardize the ethical guidelines used to conduct6 research in Europe, as the authors form part of the European Network for Academic Integrity (ENAI), the “first European consortium established to assist academic integrity” (Sivasubramaniam et. al., 2021, p. 2).

Background Literature

The article starts with high impact verbiage to describe ethics and ethical behavior, such as fundamental pillars, precedence, transform, indispensable. These descriptions immediately catch the readers attention and remind them of the importance ascribed to holding up an ethical standard in research. The authors’ stated premise for the paper is an inconsistency in how ethical standards were being applied and taught (Sivasubramaniam et al., 2021). The literature review conducted focused on looking at responsible research practice (RPP), which they defined as an all-encompassing approach to integrity in research beyond just the operational parts (Israel and Drenth, 2016).

Several of the key RRP enhancements discussed from The Singapore Statement on Research Integrity were transparency, truthful representation, respecting contributions, truthful reporting, encouraging integrity through education, among many others (2020). The authors discuss the possibility that researchers can self-govern when it comes to ethical research, with the hope that they internalize this ethical approach as an integrated behavior, not just an exercise on paper. This self-governance can and should result in high quality research. An example is then discussed regarding early human vaccination trials in the 1700s, where the test subjects were immediate family members, which according to the moral justification of that time period was acceptable (Fox, 2017). The authors then state that currently this would not be ethically acceptable, but don’t elaborate any further. This is the only weak point noted in this paper, as the authors could have elaborated why and how this practice doesn’t stand up to modern ethical research.

Ethical advisory committee (EAC)

The paper adequately covers a big picture history of ethical governance by giving a brief overview of the Nuremberg code, followed by the Helsinki Declaration, and then the Institutional Review Board (IRB). Many of the different governing entities and their basic structures are discussed along with what areas they cover. These ethical advisory committees are either at a national or a regional level and are responsible for reviewing study proposals and issuing ethical guidance (Council of Europe, 2014). 7

Ethics vs morals

The highlight of the article is the discussion on the differences between ethics and morals. The authors state that although these terms are sometimes used interchangeably, that is incorrect as they have separate meanings. Ethics is related to rules from an external source such as a workplace code of conduct (Kuyare et al., 2014). On the other hand, morals are about an individual's own principles in regards to right and wrong (Quinn, 2011). They continue by discussing how there are not much scholarly research in this field that distinguishes ethics from morals, and conclude that in research and academia the term ethics should be used instead of morals (Sivasubramaniam et al., 2021).

Conclusion

After a great introduction, a solid discussion on EAC, and distinguishing between ethics and morals, the authors conclude their article by discussing what they view is their mission in ENAI as an ethical working group. The main points discussed are that they exist to render advice, act as a guide in ethical standards, collaborate and provide support and training in this field. They go a step further and start laying out the process for how to setup an institutional ethical committee (EC), what the approval process looks like for this committee once it is setup, and how this EC should provide education to further ethical culture.

References

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Examples SLO 2

Thesis Statement Example 1

Using the guidance provided in LM 3 (Videos and Purdue Owl), upload an example Thesis statement for a research topic related to your research interest area. This item is due no later than Friday, September 24th by 6:00pm (central time).

Aviation is an extremely expensive and complex industry with high potential for safety incidents, leading experts to continuously research ways of lowering costs, increase quality of training, and minimize risk. Visual and augmented reality in aviation training simulation has begun to fill that need experts were looking for, as there have been proven studies on its ability to immerse the pilot in a more realistic environment and help improve the flying skillset. However, as this research will show, when the complexity of the aviation task at hand increases significantly there is a point at which simulation instead of performing the task in the aircraft can in effect hamper pilot learning and proficiency. Due to this occurrence, using the new USAF Pilot Training 2.5 as the study case, the emphasis of virtual and augmented reality training should occur in the early phase of training but taper down in more advanced training, as its benefit during complex events diminishes significantly when compared to the learning that happens when flying.

*note: I used the guidance from your video that discussed thesis being 6-7 sentences, as opposed to the Purdue guidance which made is seem more like just one sentence.

Thesis Statement Example 2

Previous aircrafts' accidents and incidents investigation findings should be the lieu to commence in the proactive hazard identification and reporting process for MROs and Line Maintenance providers:
The paper that follows should:
Explain how relying of previous findings of aircrafts' accidents and incidents investigation could increase the number of proactive hazards identification and reporting for MROs and Line Maintenance for their SMS program.

Problem Statement Example 1

The advances of virtual and augmented reality in aviation simulation have allowed training quality to increase and cost to decrease exponentially in recent years. However, there is a point of diminishing return where too much simulation as a substitute for flying could have a negative outcome, potentially decreasing a pilot's situational and air awareness, and creating a less safe environment.

Problem Statement Example 2

Though SMS for 121 operators is now mandatory in the United States, others non-121 operators like MROs and line maintenance service providers that service these airlines face the challenge of clearly implementing a proactive hazards identification and reporting through their Voluntary SMS program. Numerous data of aircraft accidents and incidents imputed to MROs and line maintenance service providers do exist, therefore what effect do aircraft accident and incident investigation findings have on the proactive hazards' identification and reporting?

Sources List Example 1

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Source List Example 2

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Mini Lit Review (methodology argument) Example 1

Why My Research Interest Area Benefits From Quantitative Research Design

Research Problem Statement

The advances of virtual reality (VR) and augmented reality (AR) in aviation simulation have allowed training quality to increase and cost to decrease exponentially in recent years. However, there is a point of diminishing return where too much simulation as a substitute for flying could have a negative outcome, potentially decreasing a pilot's situational and air awareness, and creating a less safe environment.

Research hypothesis

Aviation is an extremely expensive and complex industry with high potential for safety incidents, leading experts to continuously research ways of lowering costs, increase quality of training, and minimize risk. VR and AR in aviation training simulation has begun to fill that need that experts were looking for, as there have been several proven studies on its ability to immerse the pilot in a more realistic environment and help improve the flying skillset. However, as this research will attempt to show, when the complexity of the aviation task at hand increases significantly there is a point at which simulation instead of performing the task in the aircraft can in effect hamper pilot learning and proficiency. Due to this occurrence, using the new USAF Pilot Training 2.5 compared to traditional Undergraduate Pilot Training as the study case, the emphasis of virtual and augmented reality training should occur in the early phase of training but taper down in more advanced training, as its benefit during complex events diminishes significantlywhen compared to the learning that happens when flying. An overreliance on AR/VR as a direct substitute for flying hours is a cost-savings event, but can bring increased and potentially unnecessary risks.

Background

Quantitative Impetus

As discussed in Goertzen's Quantitative article, one of the primary functions of quantitative research is to "provide evidence of success and highlight areas where unmet information needs exist" (2017, p. 3). There is not an abundance of research or seminal work on this topic of AR/VR replacing flying, creating an unmet information environment that would benefit from in-depth research attempting to show statistically significant results. The best method to show something is statistically significant is via quantitative design, which entails "manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect" (Sukamolson, 2007, p. 2).

Quantitative Design

One of the challenges for this research will be to gain permission and have access to the data required to effectively accomplish the proposed research. However, I have previously successfully completed a study comparing two classes of pilot training for a Master's level research project related to use of a GPS simulator to aid in GPS proficiency in the T-6 Texan II. During this research specific data was collected and analyzed with a quantitative design. The initial thought is to compare one class of around 25 students of UPT 2.5, which incorporates AR/VR, to another class of similar size that completes training the traditional way with no use of AR/VR. I am not sure if this will be able to produce statistically significant results with this sample size, and will need to do further research to determine this. Examples of data collected will be safety incident and accident trend information, along with specific grades and results of the different check rides accomplished throughout the training. The number of simulator and flight hours will be compared as well.

Additionally, as this research will try to uncover a given reality in comparing two pilot training methods, and will be conducted as objectively as possible, this ties into quantitative research as the ideal method (Sukamolson, 2007). Finally, as this research will be accomplished via the testing of a hypothesis which attempts to explain at what point students training via augmented and virtual reality versus flight is of reduced value, quantitative research remains the best fit to test and prove a hypothesis.

One method that will likely be utilized is surveying the instructor pilots who have experience in both traditional and 2.5 pilot training to get their professional opinions on the incorporation of AR/VR into the training. According to Creswell in Table 1.4, these surveys can be done in a manner to produce quantitative results by using closed-ended questions (2020), or use of a Likert Scale to attribute numerical value to a response.

Existing Studies

While not numerous, there are a few existing studies that research AR or VR as it relates to aviation. One paper that researches a remote pilot with AR glasses uses an observational study method (Coleman & Thirtyacre, 2021). Another study conducted at Embry-Riddle Aeronautical University concerning VR in flight training used a quantitative research method with a cross-sectional survey design (Fussell, 2020). In a different but related field, Sportillo et. al. researched automated driving using VR to study response times using experimental pretest and posttest measures (2018). All of these studies, plus a few additional one that were not mentioned, used quantitative design to conduct their research.

Conclusion

There is potentially a way to perform this research with a qualitative design, but as previously discussed, there is overwhelming support for approaching it with a quantitative design. This will allow concrete and specific data sets to be gathered and analyzed in an attempt to produce statistically significant results and show that AR/VR is beneficial as a substitute for flying in Undergraduate Pilot Training, but only up to a certain point, after which it can become detrimental.

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Mini Lit Review Example (methodology argument) 2

Abstract This paper discusses whether the aviation field literature is quantitative or qualitative. Also, it outlines why is quantitative research is dominant over qualitative research. For research in aviation and related subjects, it is assumed that the research question is the determining factor in the method used, and that the methodology chosen is submissive to and dependent on the answers sought (Constantin et al., 2012). However, due to the nature of aviation knowledge as empirical and experimental research, most aviation literature is quantitative. The aviation field relies on physics, mathematics, and practical sciences. In addition, most aviation research is conducted on aviation safety, which is more quantitative. While aviation qualitative field studies and observes the human relationships, communication, interaction, and activity, qualitative research still needs to fill the gaps in aviation literature, especially when studying human attitudes and behaviors in aviation.

IS AVIATION LITERATURE QUANTITATIVE OR QUALITATIVE?

Is Aviation Literature Quantitative or Qualitative?

Before we study the aviation literature, whether quantitative or qualitative, we will briefly discuss the common types of research methodology. There are three research methods are commonly used. Quantitative, qualitative, and mixed methods. The quantitative method is used to quantify or convert collected data such as behaviors, or attitudes to figures and numbers without changing the core meaning of the collected data (Creswell, 2018). The quantitative method (numbers & hypotheses) uses closed-ended questions and responses during the collection phase of the method. The qualitative method is used to explore and understand opinions, thoughts, views, and experiences of the participants so the researcher can make an interpretation of the meaning of the collected data (Creswell, 2018). The qualitative (words & interviews) uses open-ended questions and responses (Creswell, 2018). Mixed method “resides in the middle of this continuum because it incorporates elements of both qualitative and quantitative approaches” (Creswell, 2018, P. 41). In this paper, I will discuss the qualitative and the quantitative literature in the field of the aviation, then I will narrow the discussion to the dominant method, and why it is considered dominant in the aviation field. The quantitative method has more existence in the natural sciences due to its involvement in the technical fields, and the aviation is considered mostly a technical (Constantin et al., 2012). Historically, early aviation researches, experiments, studies, and topics were based on mostly physics, mathematics, engineering, chemistry and practical knowledge, and these fields are empirical in nature and based on quantitative research methodology (Constantin et al., 2012) During the early stages of aviation industry (growth stage), aviation field was mostly depending on the empirical and natural science, but after reaching the maturity stage resulted in rising other researches, studies and topics in different fields related either directly or indirectly to the field of aviation such as human factors, human factors systems, and aviation medicine (Constantin et al., 2012). However, great deal of researchers believes that using quantitative methodology in the aviation field has some drawbacks such as separation of the human element from the research (Constantin et al., 2012). Employing quantitative research in aviation field provides some benefits: objective, specific, rational analysis, simple to document, and it's useful for modeling while using qualitative research in aviation safety has some advantages, such as connecting and comparing unrelated pieces of quantitative data, evaluating the value of quantitative data, and narrowing the range of possible safety judgments (Britton, 2017). Many researchers believe that qualitative research is less rigorous than quantitative research, and it is more likely to produce common-sense results in the aviation field (Deaton, 2019). Qualitative research, or even mixed-method studies, could give new aspects to aviation research that is now being conducted (Deaton, 2019). Much of quantitative research in the field of aviation, like other disciplines, is based on participants' subjective answers, so what we consider "objective" may not be so (Deaton, 2019).

"Psychology in general has accepted the viewpoint that qualitative research is as valid as quantitative; however,1I8think aviation research is a bit behind in recognizing the value of qualitative data" (Deaton, 2019, para. 5). The realization of this necessity drives the increased need for qualitative research approaches in the aviation industry. Since qualitative research can study complex phenomena that are not suitable for quantitative research and can achieve the characteristics of complex behaviors and relationships, so more qualitative research methods are needed to support it (Constantin et al., 2012). The aviation researcher uses the observation of communication, interaction, and activity within a closed group of individuals in the qualitative study, and the results of this model's research present the cultural description, this concept is effective particularly in the aviation industry (Constantin et al., 2012). The human component in aviation, such as flight crews, air traffic controllers, and engineers, form independent professional teams in the aviation industry, but they must work together in a symbiotic relationship to meet operational requirements, hence the need for a qualitative study to interpret the human behavior along with the systems. (Constantin et al., 2012). Not only is the aviation world an 'evolved construct,' but the data collection tools themselves, such as performance narratives, Aviation safety reports, accident reports, etc., are usually unrestricted in format, so they are qualitative in nature (Constantin et al., 2012). Obviously, studies on human performance, particularly in aviation topics, frequently use hybrid approaches, in which the research topic is grounded in quantitative data, the research is based on quantitative method, and the results are presented in a quantifiable way; However, careful study of the data collection method raises questions about the method used, and the result is usually a numerical description of the qualitative process. This process often reduces the narrative to pure numbers (Constantin et al., 2012). Why is The Quantitative Research More Suitable for Aviation Field? The quantitative method is more suitable for aviation field research because the majority of aviation research is focused on the improvement of aviation safety. Hence, most researchers prefer to conduct their research from a positivistic standpoint due to the need for statistically driven measures by regulators and prudential authorities and a perceived requirement for findings free of subjectivity (Constantin et al., 2012). Quantitative research aims for results that are free of subjective interpretation and human influence; because of these factors, the quantitative method has become a prevalent and desirable research methodology in a wide range of disciplines, particularly when the results are meant to support organizational, governmental policy or capital investment (Constantin et al., 2012). For a long time, quantitative research has dominated fields like physics and mathematics, and its influence even has spread to the medicine, psychology, and aviation science due to its reliance on both mathematics and physics. Historically, most organizational research, especially in aviation, is considered quantifiable in nature; this is why it is mostly conducted under a positivistic methodology (Constantin et al., 2012).

Conclusion Quantitative research in aviation is the dominant due to the nature of the aviation field and its reliance on the natural and technical sciences. The research in the aviation field is typical of most disciplines, in these disciplines, the progress of research results is defined by substantial initial breakthroughs, followed by slightly insignificant improvements to existing knowledge (Wiggins & Stevens, 2016). The research question is the main factor that determines the research method that to be used for the research, and one of the most challenging tasks for a researcher is to come up with an appropriate research question (Creswell, 2018). In aviation research, quantitative data can fill the gaps in qualitative data by supporting a qualitative value assessment with quantitative facts. In addition, to determine the value of quantitative data, an expert's qualitative opinion may be used. In the aviation field, many researchers think that qualitative research is less rigorous and more in line with common-sense results. Qualitative research, or perhaps even mixed-method studies, could add another dimension to the research as we are seeing today (Deaton, 2019). Quantitative research methodology has been, and continues to be, the preferred research methodology under which aviation research is conducted (Constantin et al., 2012).

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Research Questions Example 1

Quantitative

1. In what specific phase of Pilot Training Next 2.5 at Vance AFB are Augmented and Virtual Reality assisted simulators shown to be more beneficial as compared to traditional Undergraduate Pilot Training students at the same base?

2. What change in safety trends can be noted with a decrease in flying time but increase in simulator time in the new pilot training format at Vance AFB.

3. What is the increase or decrease in student performance as denoted in the grades assigned in the four separate check rides taken when comparing Pilot Training Next 2.5 students to Undergraduate Pilot Training Students at Vance AFB?

Qualitative

1. Do instructors who have experience in both traditional and Pilot Training Next 2.5 describe a perceived benefit to increasing the amount of Augmented and Virtual Reality while simultaneously decreasing the flight hours a student pilot receives?

2. What are the main factors associated with transitioning to relying more on augmented and virtual reality than on flying during pilot training?

3. Do Pilot Training Next 2.5 students rate that adding Virtual and Augmented Reality to their training improves their learning, and if so, what reasons do they ascribe to that?

Research Questions Example 2

The purpose of my study is to examine the impact of proactive hazard identification in line and hangar maintenance on commercial aviation accident trends.

Quantitative research questions:

1- What is the impact of proactive hazard identification in line and hangar maintenance on commercial aviation accident trends?

2- What is the impact of the implementation of SMS on maintenance operations?

3- What is the contribution of previous airline accident investigations on hazard recognition?

Qualitative research questions: 21

1- Does an orderly disposed tool in a toolbox contributes to a safer maintenance operation in aviation?

2- Do safety posters about the dirty dozen have an impact on hangar and line maintenance operations?

3- How human factors impact safety in aviation maintenance?

Graduate Course Performance Indicator Rubric

Assess Student Learning Outcomes

Course: ASCI 5020 Aviation Safety Data Analysis Course Instructor: Gajapriya Tamilselvan

Semester Taught: Fall 2021 Number of Students in Course: 5

Student Learning Outcome Assessed	Assessment Results: (Indicate what % of class achieved a minimum score of 80%)	Benchmark achieved? (Benchmark: 80% of students will score a minimum of 80% = "B")
SLO 2: Apply the major practices, theories, or research methodologies in the aviation field of study.	Critical Analysis of Research Article – 100%; AVG = 100%	Elements of Assessment (Critical Analysis of Research Article) yielded 100%, exceeding the desired benchmark of 80%.
SLO 4: Graduates will be able to serve as leaders in the aviation/aerospace industry by applying theories, concepts, and knowledge or developing strategies to resolve issues in the aviation/aerospace industry.	Field Research – 100%; Archival Research – 100%; AVG = 100%	Elements of Assessment (Field Research/Archival Research) yielded 100%, exceeding the desired benchmark of 80%.

Course Assessment (Intended Use of Results)
The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

The assessment of SLO 2 met the desired benchmark, where the students evaluated a published research article in aviation safety and presented their critique using the specified criteria in the course. The assessment of SLO 4 met the desired benchmark, where the students designed and conducted a safety-related field/archival studies and presented their research findings as technical reports. For upcoming semesters, same assessment tools 'critical analysis of research article, field research, archival research' will be used for evaluating student learning outcomes.

**Attach description of assignment used for assessment and samples of student work.*

Critical Analysis of Research Article – Sample Student Work

1. Unsafe Missed Approach Procedures

Research Problem and Rationale

The research article I reviewed is titled ‘Does Specific Flight Experience Matter? The Relations Between Flight Experience of Commercial Aviation Aircrews and Missed Approach Incidents’ written by Jack Limor and Avinoam Borowsky. Any pilot knows that in theory, missed approach procedures are simple if all steps are followed in chronological order. The problem is that when required to execute, many commercial airline pilots struggle, and it results in an unsafe missed approach procedure as well as a potential crash. Even though automation in commercial airliners is extensive these days, “there are yet mentally demanding situations that may result in pilots’ error” (Limor & Borowsky, 2020, p. 38). Not all missed approaches are the same, and they may even include single engine missed approaches which have different procedures.

The purpose of the research article was to study and explore “the relation between [specific flight experience] (SFE) of commercial aviation aircrews and their performance during unsafe missed approach procedure (MAP) incidents” (Limor & Borowsky, 2020, p. 39). SFE is considered “the pilot’s flight experience on the specific airplane’s type rating that was involved in the safety incident” (Limor & Borowsky, 2020, p. 41). While examining past MAP studies, these studies tended to examine the relationship of overall pilot time, but not how it relates to SFE. Because of this, two research questions emerged from the research article. The first question was trying to determine if there was any sort of relationship or trend between the Captains (CAP) and First Officers (FO) SFE. The second question was trying to determine if the aircrews SFE combination would affect their performance during the MAP.

While considering the two questions of the research article, Limor and Birkowsky developed three hypotheses:

(1) Of all the 65 MAP events, the number of incidents involving aircrews that either their CAP or FO possesses a low level of SFE will be significantly higher than the number of incidents involving aircrews that either their CAP or their FO possesses a high level of SFE.
(2) Referring to an aircrew as a coherent unit consisting of a CAP and an FO, the number of incidents involving aircrews with inexperienced CAP and FO will be higher than the number of incidents involving aircrews with experienced CAP and FO.

(3) When a CAP, who usually has more flight experience than his FO, is acting as a [pilot flying] (PF), the aircrew will be at less risk of being involved in an unsafe MAP incident, compared to situations where the FO is acting as a PF. (Limor & Borowsky, 2020, p. 39)

Being able to answer the research questions and validate the hypotheses was important for the researchers. If there was a direct correlation between CAP and FO's SFE regarding unsafe MAP, then airline schedulers could potentially try to deconflict at risk crews or at least make them aware.

Methodology

The methodology for this research utilized quantitative analysis. Building from one Limor and Borowosky's previous research studies, they "retrieved formal investigation reports of MAP related accidents and incidents…in order to explore the type and number of errors that pilots made during these incidents" (Limor & Borowsky, 2020, p. 40). These reports were pulled from commercial aviation open-source databases such as SKYRARY, ASAR, etc. In total, the researchers initially collected 102 relevant safety reports between the years 1990 and 2014. From there, reports were excluded if the pilots did not initiate a MAP (even if the criteria for a MAP was met) as well as any reports which did not adequately describe the pilots' action during the MAP.

All the MAP events were classified into five possible categories. The five possible categories are no visual contact with the runway, non-stabilized approach, malfunction, traffic conflict, and crew/controller decision. The MAP events and how the pilots performed are considered the dependent variable for the research while the SFE which was focused upon by the researchers are the independent variables. For the independent variables, the CAPs and FOs were classified as either low, intermediate, or high level of SFE experience. Low SFE is considered less than 500 flight hours which is roughly equal to a 6-8 month period. Intermediate SFE is between 500 and 2000 flight hours which is roughly equal to a 6-30 month period. High SFE is greater than 2000 flight hours which is roughly equal to greater than a 30-month period.

Typically, most commercial airline pilots are on a long-term contract, therefore the ratio of low, intermediate, and high level of SFE CAPs and FOs can be determined. Researchers assumed the distribution of low, intermediate, and high SFE pilots in an airline is 10:20:70 based off the mandatory Federal Aviation Administration (FAA) retirement age of 65 (Limor & Borowsky, 2020, p. 42). Since this ratio is an educated estimate, Limor and Borowsky also established an upper bound of 5:15:80 and lower bound of 15:25:60 to offset the threat of validity to their expected results (Limor & Borowsky, 2020, p. 42).

Research Findings

The research findings for this study ended up being surprising on several fronts. The first analysis of experience distribution amongst unsafe MAP or crashes was the first surprise. Listed below in Figure 1 is the table of MAP events according to the CAP/FO SFE. The researchers compared the expected to actual results and performed a Chi-square analysis to highlight any statistically significant deviations. In the chart, any bolded 'Z' value indicated a significant deviation from expected to actual. The results confirmed the first hypothesis that FOs with low SFE were more likely to be involved in MAP events compared to more experienced FOs, but this was not the case with CAPs. Instead, CAPs with intermediate and high SFE showed a significant statistical deviation, and not low SFE. It is important to highlight as well that intermediate SFE CAPs had the highest statistical deviation. Because of this, "CAPs with intermediate SFE were significantly more likely than expected to be involved in a safety incident" (Limor & Borowsky, 2020, p. 46).

Figure 1 (Limor & Borowsky, 2020, p. 43).

Table 3. Classification of MAP events according to their type and the level of flight experience of the FO/CAP.

			Decision making		Consequences			
Situation	All MAP events		No Initiation of MAP, upon criteria		Abnormal Maneuver		Crash	
Rank	CAP	FO	CAP	FO	CAP	FO	CAP	FO
Below 500 FHr on this type of airplane (Low)	5 [6.5]	18 [5.3]	3 [3.7]	13 [3]	2 [2.2]	9 [1.9]	1 [1.3]	6 [1.3]
z – Value	0.6202	**5.8149**	0.3836	**5.9270**	0.1421	**5.4295**	0.2774	**4.3452**
Between 500–2000 FHr on this type of airplane (Intermediate)	22 [13]	24 [10.6]	14 [7.4]	13 [6]	5 [4.4]	7 [3.8]	8 [2.6]	5 [2.6]
z – Value	**2.7908**	**4.6016**	**2.7126**	**3.0533**	0.3198	1.8353	**3.7442**	1.6641
Above 2000 FHr on this type of airplane (High)	38 [45.5]	11 [37.1]	20 [25.9]	5 [21]	15 [15.4]	3 [13.3]	4 [9.1]	2 [9.1]
z – Value	**2.03**	**7.8234**	**2.1166**	**6.5452**	0.1861	**5.1564**	**3.0867**	**4.2971**
No information	0	12	0	6	0	3	0	0
All $X^2_{2,0.95}$	7.813	65.733	7.363	51.926	0.11	37.20	14.142	24.747
p – Value	0.02	0.000	0.025	0.000	N.S	0.000	0.000	0.000

Note: The number in bracket represents the expected value based on a 10:20:70 distribution. Significant differences between the observed and expected values are bolded.

There are several reasons the researchers concluded that intermediate SFE CAPs were more likely to be involved in unsafe MAPs. First, the researchers established the assumption that “when pilots follow regulations, they are less likely to be involved in a safety incident” (Limor & Borowsky, 2020, p. 46). Because of this assumption, low SFE CAPs are more likely to follow rules and regulations by the book since they have ‘respect’ for a new type of aircraft they are flying. By following the rules and regulations by the book, low SFE CAPs will typically initiate a MAP when appropriate criteria are sufficed, rather than attempting to ‘save’ an approach. High SFE CAPs are not only familiar with the limitations and capabilities of the airplane, but they are more capable to handle a situation approaching a safety boundary. This leads us to medium SFE CAPs. Medium SFE CAPs have gained just enough experience where they may be overconfident in their abilities when handling unusual situations during MAPs. This is one reason why in the military, we always warn our aircraft commanders to be careful and vigilant during the 750-1500 hour timeframe. Overconfidence in our capabilities is one of the major reasons aircraft mishaps can occur, and this is true in both the commercial sector as well as the military.

The second finding the research team discovered was the opposite of their third hypothesis that when CAPs are acting as PF, they are less likely to be involved in an unsafe MAP. Figure 2 below shows MAP events according to who the PF is during the MAP event. As the researchers identified, when the CAP is PF, there is a higher probability (nearly twice as likely) of an unsafe MAP event occurring (Limor & Borowsky, 2020, p. 45). The researchers hypothesized that the reason for this is because low SFE FOs lack self-confidence and are less likely to call out deviations or criteria which would lead to a MAP. As the pilot monitoring (PM), "the FO should monitor and cross-check, all of the PF operations and immediately declare and deviation from regulations and procedures" (Limor & Borowsky, 2020, p. 47). What unfortunately tends to happen with low SFE FOs is that they rarely speak up during these unsafe MAP events.

Figure 2 (Limor & Borowsky, 2020, p. 45).

Table 5. Descriptive statistics of the number of events where either the CAP or FO took the role of the PF.

Situation			Role as PF: CAP	FO	NA	Total
All events		Number of events	41 [31.5]	22 [31.5]	2	65
			$X^2_{1,0.95} = 5.73$		$p = .016$	
Decision making	No initiation of G/A upon criteria	Number of events	24 [17.5]	11 [17.5]	2	37
		Ratio of No initiation events out of total, Cap vs. FO	$X^2_{1,0.95} = 4.829$		$p = .028$	
Consequences	Abnormal maneuvers situation	Number of events	13 [10.5]	8 [10.5]	1	22
		Ratio of abnormal situation events out of total, Cap vs. FO	$X^2_{1,0.95} = 1.19$		p = N.S	
	Crash	Number of events	9 [6]	3 [6]	1	13
		Ratio of crash events out of total, Cap vs. FO	$X^2_{1,0.95} = 3$		p = N.S	

Note: The number in bracket represents the expected value based on our 50:50 distribution.

The final finding from the research is that one of the most critical components of avoiding an unsafe MAP is having a high SFE FO. The reason for this is that senior FOs are more capable at both PF and PM duties. They have been able to obtain a significant proficiency hours/time wise to safely execute an approach (and MAP when necessary), and have the self-confidence to speak up when they are PM. Therefore, the likelihood of an unsafe MAP is drastically decreased when a senior FO if part of the crew, regardless of the SFE level of the CAP.

Critique

The researchers found three conclusions/recommendations resulting from their research. The first recommendation is that CAPs knowledge base needs to be enhanced around the 500 flying hour mark to try and avoid and possible risk/safety events from occurring. The second recommendation is that flight simulator should be used more often, specifically focusing on a multitude of MAP events to try and further prepare flight crews. The third recommendation is that CAPs need to put more of an emphasis on briefing/explicitly telling FOs that whenever they think a regulation or limit has been breached to speak up. I personally think this recommendation is a generic one and doesn't necessarily address the underlying issue. This issue may require further discussion amongst the training department to properly convey to junior FOs the importance of speaking up when deviations occur.

Overall, I think the researchers have a convincing case for their recommendations based upon the research. While I wouldn't disagree with any of the recommendations, I do think that they are missing a critical one; FO training. One of the major conclusions I drew from the research (and personal experience), is that there is a problem with low SFE FOs speaking up. Many junior FOs, who have not been part of a crew concept before, struggle with the ability to speak up to a CAP when deviations occur. If this was emphasized more in training and practiced in the simulator, many unsafe MAPs could potentially be avoided.

While the researchers utilized an appropriate quantitative methodology (one which I think was the biggest strength of the research), I do think that a larger database could have been generated as well as a follow up qualitative study. While the quantitative study supplied important information, a qualitative study needs to follow to do a better job at explaining the 'why'. This is the biggest weakness in my opinion. They attempt to explain why unstable MAPs occur based off the raw data, but they appear to be missing the human element – which can be effectively studied through qualitative data. There needs to be a deeper understanding of why FOs don't speak up rather than just saying they are inexperienced and lack self-confidence. There is most likely a multitude number of reasons why low SFE FOs don't speak up. As an example, prior military low SFE FOs who have been aircraft commanders typically don't have a problem speaking up when they see an issue/deviation. Based off this logic, there must be another reason then a lack of self-confidence. Therefore, the study is incomplete in explaining the ‘why,’ and rather it just points out the problem.

If I was to conduct this study, I would use a mixed-methods approach. I would build off what they have and draw on a much larger database, and I would potentially try to team up with a major airline to draw out additional safety information. After I had adequate data and results, I would then formulate a qualitative survey to be given out to the pilots (at said airline) to try and better explain the ‘why’. By using a mixed-methods approach, I would be able to use the strengths from the quantitative study conducted and use the qualitative survey to combat the weaknesses I found from the research study to paint a more wholistic picture.

Reference

Limor, J., & Borowsky, A. (2020). Does Specific Flight Experience Matter? The Relations Between Flight Experience of Commercial Aviation Aircrews and Missed Approach Incidents. International Journal of Aerospace Psychology, 1–2, 38.

2. Airplane Pilot Mental Health and Suicidal Thoughts: A Cross-Sectional Descriptive Study Via Anonymous Web-Based Survey

A Quantitative Research Analysis

Airline pilot mental health was brought to the forefront of aviation safety concerns in March of 2015 due to the intentional crash of Germanwings Flight 9525. A 2016 quantitative research study conducted by Wu et. al. attempted to identify root causes of major depressive disorder amongst the airline pilot community following Germanwings flight 9525.

Research Problem and Rationale

The purpose statement effectively illustrated the intent of the study by illuminating the need for accurately describing mental health and symptoms of depression among airline pilots. Their research objective was placed in the last paragraph of their background, and while the information outlined before the purpose statement was necessary, the authors should have clearly stated the purpose of the research within the opening paragraph. Additionally, they do not outline specific research questions nor hypothesize outcomes of the survey. Rather, they merely intend to uncover unidentified mental health trends of airline pilots.

The background of this study breaks down the Germanwings incident and suggests that the co-pilot's possible clinical depression was the cause of his actions. In an effort to understand depression with airline pilots, the background establishes known statistics of people suffering from major depressive disorder (MDD). MDD is further explained by being characterized by at least two weeks of depressed mood or loss of interest along with several other symptoms such as significant distress and social, occupational, and life activity impairment. 350 million people worldwide suffer from depression, and the background effectively dichotomizes the relationship between several high-stress jobs such as U.S. deployed military personnel, emergency medical technicians, and police officers (Wu et al., 2016). The background also addresses that there are no known studies that address pilot mental health appropriately; furthermore, the authors note the known stigma of mental health and pilots protecting professional interests could leave to underreporting. Airline pilots may under report mental health information in order to preserve their employment status. Airline pilots' livelihood depends on being mentally and physically healthy, and if there is documentation of mental health issues, it could jeopardize the livelihood of pilots and further harm their mental health.

Methodology

The research study's population included a strong sample of airline pilots from the United States with 1,586 participating. Additionally, the remaining majority of airline pilots who participated represented the countries of Canada, Australia, Spain, the United Kingdom, Germany, United Arab Emirates, Hong Kong, Thailand, Columbia, Brazil, and Chile. There were a total of 3,485 participants with a completion rate of 52.7%. The methods of dispersing the survey included targeted emails, newsletters, discussions with pilots, and advertising with pilot unions, airline representatives, pilot groups, and safety organizations. Because the intended research needed to include both men and women, the researchers specifically targeted female pilots in order to get a significant n number for appropriate analysis. They deliberately recruited more female pilots due to the small percentage of females within the industry.

This survey used specific questions from the Job Content Questionnaire and the Centers for Disease Control- National Center for Health Statistics (CDC-NCHS) National Health and Nutrition Examination Survey (NHANES) which was previously used to understand the health of U.S. flight attendants (Wu et al., 2016). These questionnaires are credible sources for obtaining pertinent, discernible responses. The researchers used Qualtrics to publish the survey and collect participant’s responses (Wu et al., 2016). The overall results were analyzed using STATA software which applied two-sided unequal variances t-test for continuous variables, Person’s chi-squared test for categorical variables, and nonparametric test for trend across ordered groups (Wu et al., 2016). This software was appropriate for running the desired tests. The independent variables include age, gender, sleep aid medicine use, diet, alcohol consumption, sexual harassment, and verbal harassment. The dependent variable within this study would be the associated depression threshold calculated. There were no concerns regarding validity due to a thorough vetting process of all participants by a professional pilot associated with the research team.

The design of this study was precisely calculated to ensure honest pilot cooperation without giving an impression that participating in the survey could lead to adverse repercussions such as termination of employment or loss of their aviation medical certificate. The survey accumulated 3,485 participants and yielded 1,837 (52.7%) fully completed responses. Those who responded with their age provided a median result of 42 years old for females and 50 years old for males. Additionally, 50% of the participants had 16 years minimum as a professional pilot, and nearly 80% had worked on an airline trip as a pilot within the preceding 30 days (Wu et al., 2016).

Research Findings

The overall results of poor mental health were distressing. All age groups had statistically significant responses to mental health issues, and females were found to have a greater proportion of having at least one day of poor mental health during the past month. 26.9% of participants older than 60 years old reported having at least one poor mental health day within the previous 30 days compared to 56.5% of surveyed airline pilots between the ages of 41 and 50 years old who reported at least one poor mental health day. Roughly 10% of respondents younger than 40 years old and 12% of pilots between 41 and 60 years old reported having at least eight poor mental health days within the previous 30 days. Additionally, 55.2% of females reported having at least one poor mental health day within the previous 30 days (Wu et al., 2016). An interesting distinction was found between males and females experiencing at least one day of problems within the previous 30 days where 43.1% of males reported having "little interest or pleasure in doing things" compared to 34.1% of women who reported in the same category. However, when attributing depression to appetite or overeating, females reported 55.1% compared to 43.5% of males surveyed (Wu et al., 2016). This distinction can infer that men experience depression as a lack of interest or pleasure in doing things more than women, but women experience depression relating to food more frequently than men.

There were 12.6% of surveyed pilots who met the clinical depression threshold level, and this was broken down by age and gender. 12.8% of males met the depression threshold, and 11.4% of females met the depression threshold. The symptoms screened as "depression" in the questions revolved around a loss of interest, feeling depressed, feeling like a failure, trouble concentrating, and thinking they would be better off dead or having thoughts of self-harm (Wu et al., 2016). Unfortunately, the most alarming result from the survey questions came from 75 respondents (4.1% of total surveyed airline pilots) who reported that they have had "thoughts of being better off dead or self-harm within the past two weeks" (Wu et al., 2016). The first half of the results that were explained were difficult to follow in-text because they continually bounce between statistics. However, once the authors addressed median total depression scores, the results were more clear. The survey results analyzed an incredible amount of information produced by this survey, and the researchers made exceptional inferences from the collected data.

Critique

Every aspect of this study is impressive and a wonderful example for further quantitative research. With it being cross-sectional, the researchers did a nice job at that specific juncture of aviation history with the Germanwings accident. The discussion and conclusion take the results and articulately explain what they found; moreover, they make inferences regarding how depression is caused and potential resources for pilots struggling with depression. The researchers establish a genuine concern for the current issues, and they greatly urge future studies. The issues with this project would be the statement regarding the total number of airline pilots and certain written presentation of data. They mention an estimated 140,000 airline pilots internationally with only 70,000 in the U.S., but a quick search within the FAA suggests there are 154,000 in the U.S. alone in 2015. Another weakness of the study would include the written display of the data. Some of the results were difficult to follow and could have been explained more effectively. Overall, the researchers presented an extremely convincing case which addressed the research problem of unidentified and unmitigated airline pilot mental health concerns, and aviation literature will benefit having this research as a foundation for future airline pilot mental health studies.

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Field Research – Sample Student Work

1. Are Regional Airline Pilots Properly Trained and Experienced?

Introduction

It is no secret that a pilot shortage has been on the horizon for aviation companies and organizations for quite some time now. With the recent global shutdown caused by the COVID-19 pandemic during the past year and a half, this timeline has been drastically accelerated. To survive during the early stages of the pandemic, airlines had to shut down training department operations and a large portion of their flight operations by sending pilots home and asking them to take voluntary leave of absences or face furloughs.

For the first year or so during the pandemic, many airlines were operating anywhere from 10-30% of their annual load factors which required them to offer early retirement packages to senior pilots to 'trim' the financial books. While this may have allowed momentary financial relief, this may have done more harm than good for the airlines in the long run. Since the airline sector recovered faster than predicted, airlines have been placing a large amount of strain on their flight crews because there simply aren't enough pilots. Many airlines have tried to mask these mass cancelations due to weather, but a large portion of the cancelations are due to a lack of aircrew and aircrew out of position due to weather. Without a flexible reserve component to airlines aircrew, any sort of irregular operations can make it difficult to recover the planned flight schedule.

Because the pandemic has made the pilot shortage even worse and accelerated the critical timeline when there won't be enough pilots to fill the planes, training departments have had to increase their throughput. Airline training departments employees were mostly sent home during the early stages of the pandemic and then recalled with short notice. This led to confusion and a lack of preparedness in many airline training departments as pilots flowed back in for indoctrination, ground school, and simulator training. Along with this, the major 'legacy airlines' have indicated that they will be hiring over 1,000 pilots a year and thousands more a year at the regional airlines. To complicate this matter further, experienced regional pilots will be flowing into the 'legacy airlines' which will leave an experience gap at the regionals. Due to the sheer number of pilot vacancies at the regional airlines, they are accepting nearly any pilot with the minimum requirements for a restricted airline transport pilot (R-ATP) certificate. Gone are the days of selecting the 'cream of the crop'. Because of this, regional airlines are seeing 6-12% failure rates in training and a good portion of pilots on 'probation' at the completion of training due to several failures during the syllabus.

The purpose of this field research is to study the impact this pilot shortage has had on the proficiency and quality of pilots at regional airlines, as well as the efficiency of airline training departments. To conduct this research, go-around/missed approaches have specifically been targeted. This is an area of interest due to the high Area of Vulnerability (AOV) this phase of flight has on the overall safety of the aircraft and passengers. Many regional airlines have identified go-arounds/missed approaches as a high area of concern due to the lack of go-arounds/missed approaches being executed when required, and when they are executed, there is a drastic and unacceptable lack of proficiency. When I speak of low specific flight experience (SFE) pilots, they are considered less than 500 flight hours which is roughly equal to a 6-8 month period. Intermediate SFE pilots are between 500 and 2000 flight hours which is roughly equal to a 6-30 month period. Finally, high SFE pilots have greater than 2000 flight hours which is roughly equal to greater than a 30-month period.

Case Study Background

Pre pandemic, to become a 'legacy airline' pilot, one would have to spend seven or more years at a regional airline. During this time at a the regional, it used to be commonplace that Captains would have five or more years of PIC Part 121 experience and would amass thousands of PIC hours. Post pandemic however, due to the accelerated pilot shortage, this is often no longer the case. As of right now, there are regional airline Captains with less than 100 PIC Part 121 Captain hours receiving interviews at the 'legacy airlines' resulting in them being pulled from the regionals early. This is leading to most regional airlines having a majority of low and intermediate SFE Captains. It is no longer commonplace to see high SFE Captains at regional airlines.

Because regional Captains are leaving for 'legacy airlines' early, it is forcing the FOs to upgrade much faster than they would have pre pandemic. To fill the gaps left by Captains within regional airlines, they are asking FOs with only 1000 hours to upgrade to Captain immediately. Pre pandemic, it was typical that FOs would take two to three years before they upgrade to Captain, and now there are virtually no medium or high SFE FOs at the regionals. This post pandemic trend amongst the pilot group experience level has led to nearly the entire FO pilots group being considered low SFE. This has tended to cause a shortage of qualified pilots to fill the FO roles as well. "Air Line Pilots Association, International (ALPA) [has argued] that the problem is not a shortage of qualified pilots, but a shortage of adequate pay for pilot positions at the regional airlines" (Lute, 2017, p. 1). As a result, due to how the airlines are being forced to operate in this new post pandemic world, it is leading to hazardous situations because the common denominator in the incidences is low SFE FOs.

Jack Limor and Avinoam Borowsky wrote a research article titled '*Does Specific Flight Experience Matter? The Relations Between Flight Experience of Commercial Aviation Aircrews and Missed Approach Incidents'*. The purpose of the research article was to study and explore "the relation between SFE of commercial aviation aircrews and their performance during unsafe missed approach procedure incidents" (Limor & Borowsky, 2020, p. 39). One of the common denominators the researchers found was that low SFE FOs drastically increased the probability of an unsafe go-around/missed approach procedure. "Under highly demanding and stressful situations… a key factor that may assist pilots to perform the task safely is their level of expertise, and specifically, their previous experience with missed approach situations" (Limor & Borowsky, 2020, p. 39). The researchers hypothesized that the reason for this is because low SFE FOs lack self-confidence and are less likely to call out deviations or criteria which would lead to a go-around/missed approach. What unfortunately tends to happen with low SFE FOs is that they rarely speak up during high AOV phases of flight.

Methodology

Participants

As the main purpose of this study is to understand the proficiency of crews with low SFE FOs, a correlational design was selected. A correlational study examines the relationships between variables that already exist with the focus group for this study being low SFE FOs. The location selected for this survey to be administered was remotely. Due to the lack of time to coordinate this survey 'officially' with a regional airline safety department, convenient sampling was administered in this study. Convenient sampling "is a type of nonprobability sampling in which people are sampled simply because they are "convenient" sources of data for researchers" (Sage, 2021). Although this type of sampling is not representative of a large or holistic collection of Part 121 low SFE FOs, it does enable an initial look into potential issues regional airlines may be experiencing post pandemic due to the pilot shortage. Because the survey was not administered through the regional airline safety department directly, many FOs were hesitant to supply the requested data. Therefore, the survey was only taken by 15 low SFE FOs. The range of age of the participants was from 23 years to 45 years. Gender was not identified in the survey since gender has no impact on a pilot's capabilities.

Survey Instrument

The survey instrument used in this study consisted of a questionnaire consisting of 13 questions. The survey was conducted through the utilization of Survey Monkey. The beginning of the survey stated that "the purpose of these questions is for a M.S. Aviation degree course ASCI5020/Aviation Safety Data Analysis at Saint Louis University. This survey does not require IRB approval, and the data collected will not have any names attached. The sole purpose of the survey is for academic purposes. If you consent, please select "I Consent," otherwise please exit the survey". The questions of the survey are as follows:

- How many total hours do you have?
- How many total Part 121 hours do you have?
- Have you completed a go-around within the past 12 months?
- If you conducted a go-around, were you the pilot flying (PF) or pilot monitoring (PM)?
- If you conducted a go-around, how senior was the Captain?
- If you conducted a go-around, was the Captain a prior ERJ or CRJ FO?

- If you conducted a go-around, what was the reason for the go-around?
- If you conducted a go-around, do you believe you were proficient even though they are only practiced in the simulator once a year?
- If you conducted a go-around, were there any issues during the execution?
- If there were issues during the execution, what were they?
- Within the past 12 months, have you not initiated a go-around even though unstable approach criteria were met?
- If you did not initiate a go-around even though unstable approach criteria were met, what was the reason or rationale for continuing?

Survey Results

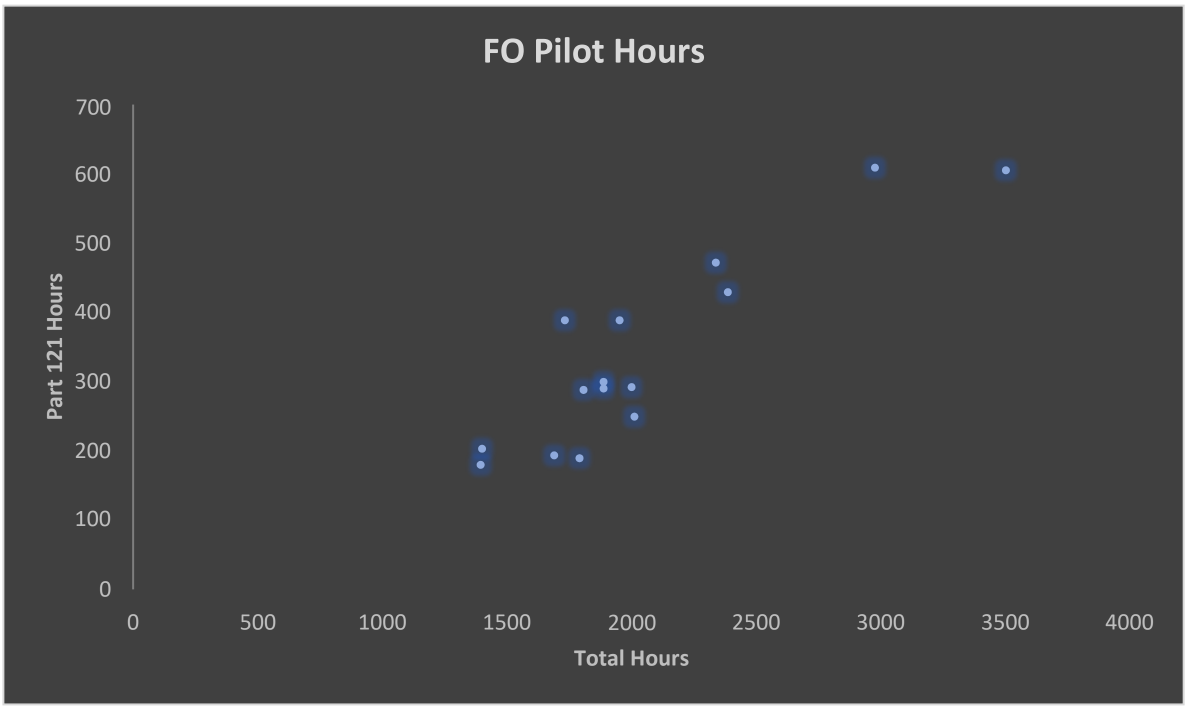

Figure 1: FO Pilot Total Hours vs Part 121 Hours

Figure 1 represents a graphical representation of the FO pilot hours experience. The X-axis shows the total pilot hours the FO has while the Y-axis shows the total Part 121 hours. This is an important correlation to show to gauge the types of experience the FOs that were surveyed have.

Figure 2: Executed Go-Around in the Past 12 Months

Figure 2 is a graphical representation of whether the FO has conducted a go-around within the past 12 calendar months. The results from this indicated that everyone has conducted a go-around within the past 12 months which is excellent data collected for the survey.

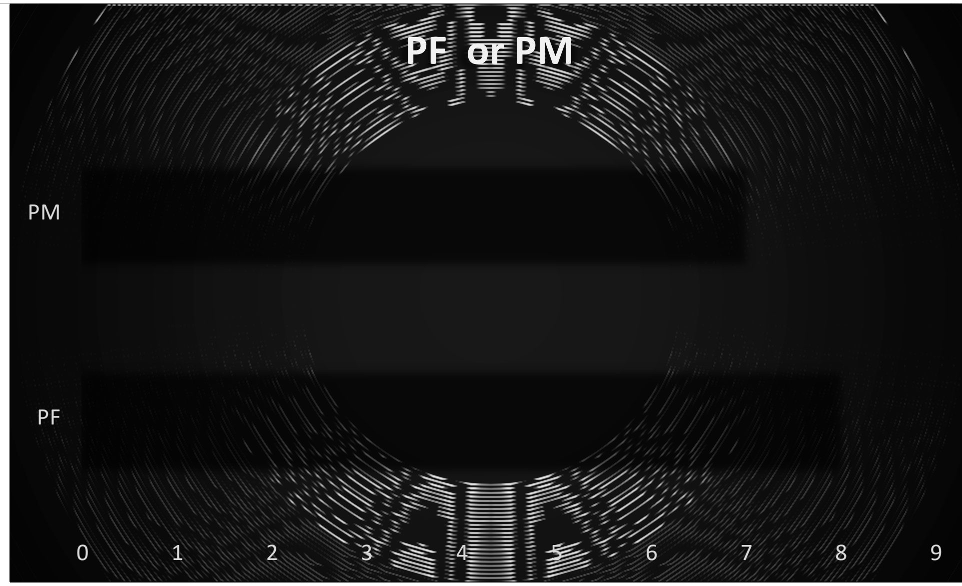

Figure 3: FO was PF or PM

Figure 3 is a graphical representation of whether the FO was the PF or PM during the go-around execution. The survey requested that if the FO has completed more than one go-around within the past 12 months to go answer with the most recent go-around they conducted.

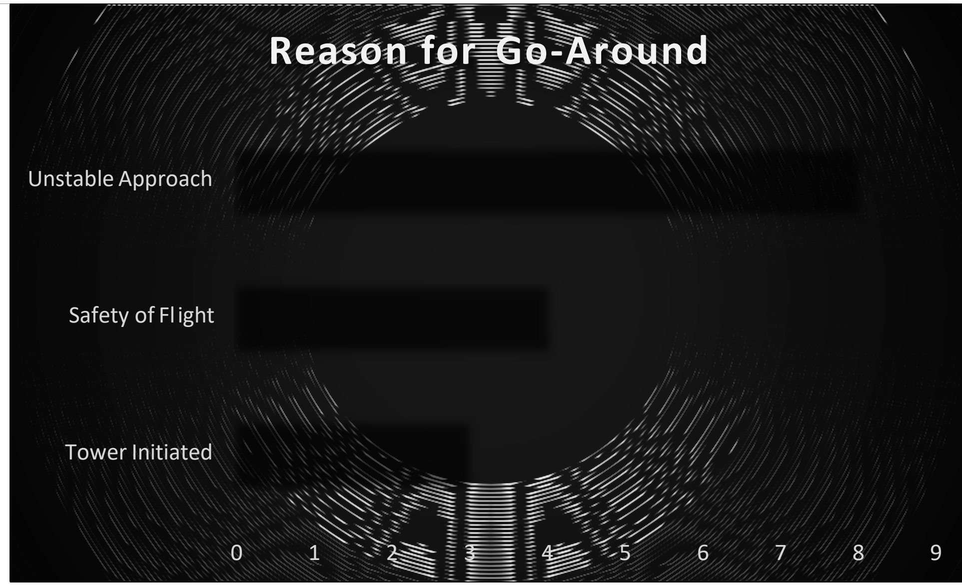

Figure 4: Reason Given for the Go-Around

Figure 4 is a graphical representation of the reason for the go-around. Although there may be several more reasons to execute a go-around, the FOs were asked to try and classify them within these three reasons. If the go-around was conducted for a reason other than tower initiated or unstable approach, safety of fight was a catch-all answer.

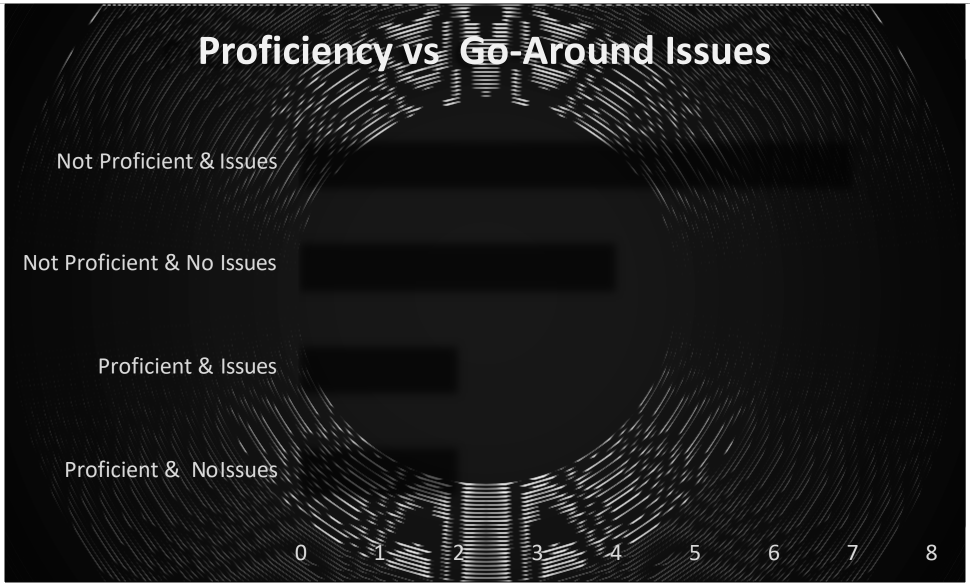

Figure 5: FO Self Evaluated Proficiency vs Go-Around Issues

Figure 5 is a graphical representation showing if there is any correlation between issues being experienced during the go-around and the FO self-evaluated proficiency level. Since go-arounds are only practice once a year in the simulator during initial training or continuing qualification, proficiency can become an issue.

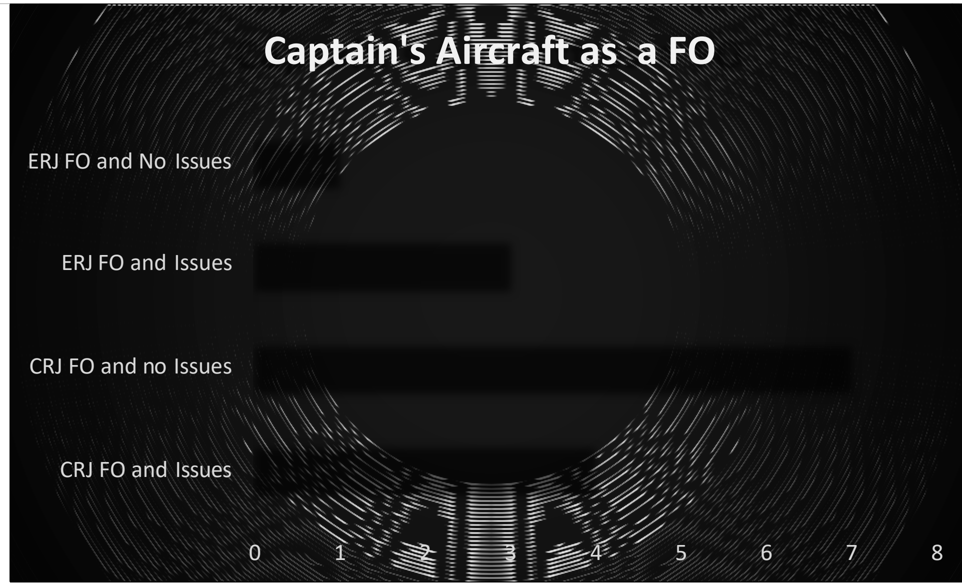

Figure 6: Aircraft Captain Flew as a FO

Figure 6 is a graphical representation of the experience level and aircraft the Captain piloted while they were an FO. There is currently a debate at regional airlines of whether pilots who upgrade should be allowed to transition from one airframe to another. There is historical data which has shown pilots who flew the ERJ as a FO have experienced significant issues when they upgrade directly to the CRJ. Reviewing two significant recent near fatal incidences/crashes, the Captain was an ERJ FO who transitioned to the CRJ as a new Captain. The increased demanding workload of the CRJ compared to the ERJ has been a data point of potential issues.

Figure 7: Continued Unstable Approach in the Past 12 Months

Figure 7 presents a graphical representation on whether a FO has continued an approach even though it has met the unstable approach criteria. The stable approach criterion at 1,000 feet height above threshold (HAT) is as follows:

- On lateral and vertical profile
- Airspeed within -0 and +10 kt of approach speed
- Thrust levers above idle
- Sink rate is no greater than 1,000 ft/min; if an approach requires a high sink rate, a briefing is required
- The aircraft must be fully configured for landing and the BEFORE LANDING CHECKLIST complete

Discussion

The findings after completing the field research are close to what I expected. Since I have recently completed regional airline training, and comparing it to my past military training, I know there are shortfalls within the Part 121 training departments. Part of this is due to the limited time they must get pilots through, but it has also been exacerbated by the pandemic manning shortage. The results from the field research shows that pilots do not feel proficient in conducting a high AOV maneuver such as go-around/missed approaches. Not only do they not feel proficient, but they are also experiencing significant safety issues while conducting them. Looking at the experience levels of the Captains is also an issue. As previously discussed, there are less high SFE Captains at the regional airlines then there used to be. Because of this, it is more common to see low SFE FOs paired with low or intermediate SFE Captains. These types of pairings have been researched before in the past and are at higher risks of experiencing an issue during the flight. Between the lack of experience of Captains in the left seat, and low SFE FOs in the right seat who are often afraid to speak up, aircrews are experiencing significant challenges. While this study only examined go-around/missed approaches, there are several other phases of flights where crews are having difficulties.

Conclusion

This field research is very interesting to me because it is one that I am experiencing and impacted by right now. Luckily with my military background and well-developed decision making, I can see many of these hazardous situations unfolding and I am not afraid to speak up. The regional airlines are often a proving ground for younger pilots, specifically those who built up most of their flight time instructing. While this type of experience is important, it does not prepare many pilots adequately for the dynamic environment of Part 121 jet flying. With the lack of high SFE Captains being more and more common in the regional airlines, I believe we will continue to see more potential safety issues/incidences occurring. While I am not offering a specific solution to this problem, I believe this research would be important for regional airline safety departments to be aware of and investigate further. Often, being aware of a potential issue is half of the battle.

One of the few ways I see this problem being able to be solved in the future would be to possibly get rid of the regional airline model. Regional airlines often do quite a lot of the flying for major airlines, and pilots are just looking to get their hours to upgrade to a ‘legacy airline’. If these regional airlines were merged with the ‘legacy airlines,’ you would not see the mass exodus from the regional airline airframes that we are witnessing now. By allowing pilots to be attached to a ‘legacy airline’ from the beginning, pilots would fly these smaller jets for longer periods of time, and the lack of FO or Captain experience would most likely diminish overnight. The other solution which could potentially solve this issue is by requiring FOs to obtain 2,000 Part 121 hours before they are allowed to upgrade. In my opinion, 1,000 hours is not enough time since it only takes roughly 12-14 months to reach. While it is good experience, pilots should be required to obtain more experience before upgrading, and this would allow high SFE FOs to be part of aircrew pairings. From past studies, high SFE FOs are usually the key factor to reducing an aircrews potential for mishaps/incidences.

Future Recommendations

The main recommendation I would make for this field research would be to greatly expand the participants. It would be worthwhile to try and contact a regional airline safety department to see if this survey could be implemented on a large scale. The ideal sample size would require all new hire FOs to complete the survey at their first continuing qualification check ride a year after initial training, as well as new Captains at their first continuing qualification Captain check ride. A larger subset of data could validate potential proficiency/training issues new hires are experiencing, and potential issues low to intermediate SFE aircrews are having because of the current post pandemic hiring trends. The final recommendation I would make is to conduct the survey with both CRJ and ERJ FOs. As of right now, this field research was only conducted with CRJ FOs. The CRJ and ERJ training departments are separate and have different syllabi. Speaking with Captains who have upgraded from one aircraft to the other, many have stated that the CRJ training department is vastly inferior to the ERJ training department. It would be worthwhile to see the differences between the two when it comes to go-around/missed approaches. If one of the departments is producing more proficient pilots then the other, then the other department needs to as well.

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2. Survey of Alertness Levels of Flight Instructors During Workday and Across Seasons

The issue of fatigue is prevalent in aviation safety, and as long as human operators are central in the aviation industry, the limitations of human physiology must be considered in all operations. While the focus of much discussion in the literature is focused on airline pilots, there remains a need for more research regarding individuals in other piloting careers. Specifically, flight instructors and flight instruction is often overlooked.

Over the last two decades, the Federal Aviation Administration (FAA) has focused on the issue of fatigue. Notably, and significantly, following the devastating Colgan Air Flight 3407 crash, Part 117 of the Federal Aviation Regulations was enacted to protect airline crew members' guaranteed rest times from airline crew scheduling practices that contribute to fatigue.

Within the conversation about fatigue is an acknowledgement of the role that circadian rhythm plays in the limitations of human safety. There has been a focus on circadian rhythm among airline crew members and, particularly, cargo airline crew members, whose work demands alertness during time periods of the day when humans are more prone to experiencing effects of fatigue.

Less focus has been paid to those who are responsible for training the next generation of airline and cargo flight crew members: flight instructors. There has been limited research conducted among flight instruction. Particularly among full-time flight instructors, who are responsible for multiple flight students within a 40+ hour workweek, the issues of fatigue present as much a safety threat as in the rest of the aviation industry.

The purpose of this research study is to determine if there are patterns in self-reported alertness levels among flight instructors. To better understand what, if any, role that circadian rhythm plays among this group of pilots, the study tracks the alertness levels of instructors over the course of the workday as well as over the seasons of the year.

Case Study Background

Since the airline industry's origins in the early 1930s, the issue of fatigue among pilots has been a concern. Studies have shown that fatigued pilot thinks more slowly, are prone to making mistakes, and have memory difficulties (Caldwell et al., 2009). These limitations mean that errors due to fatigue are not only a risk to the pilot, but to passengers, payload, and individuals on the ground. Some factors that contribute to fatigue are unpredictable work hours, long duty periods and circadian disruptions (Caldwell et al., 2009).

A Brazilian study focused on changes in alertness over seasons. The study found that crew members (both pilots and flight attendants) experienced periods of minimal effectiveness at a higher rate in January and July than they did in May, and overall the study detected a significant effect of seasonality between high and low seasons of work (Rodrigues et al., 2020).

While few studies have been done on flight instructors, attention has been given to flight students. A study within Purdue University's flight program focused on flight students and found that fatigue had played a role during flight training (Mendonca et al., 2019). Many Part-141 flight instructors were, in the preceding few years, students of flight training programs, and the flight training department culture and expectations are set largely by instructors. Thus, a study that found trends of fatigue among its student population would be served to also investigate whether the same issues affect its instructor group.

Finally, humans' circadian rhythms are dependent on light. A study in 2013 oversaw the influences that various factors of industry have on the circadian rhythm and humans' sleep-wake cycles. Notably, the study concluded that "sun time is more important to human temporal biology than social time" (Roenneberg et al., 2013). The researchers specifically noted that daylight savings time changes social time for humans, but those humans are still impacted by physiological responses to the light-dark sun cycle. A downstream effect of this shifting environment to circadian misalignment is chronic sleep restriction, substance abuse and metabolic challenges (Roenneberg et al., 2013). Though individuals in all industry are expected to experience circadian rhythm effects from seasonal time changes, the risk of increased fatigue among pilots has a more direct threat to the line of work.

Methodology

Participants

With the knowledge that level of fatigue changes throughout the 24-hour day-night cycle, as well as across seasons of the year, an investigation through a population with a more-stable aviation workday led to the conclusion that flight instructors' levels of alertness should be tracked during each day and over the seasons of the year.

As established through the literature, unpredictable work hours, long duty periods and circadian disruptions contribute to fatigue among airline pilots. While flight instructors are not regularly changing time zones and handling rapidly changing work hours, they are a quality test group to look at the effects of long, intense duty periods and of the shifting impacts of fatigue throughout a day and over the course of yearly seasonal (environmental) changes. Additionally, some duty days must be extended to meet the needs of their flight students.

Participants for this study were all Part 141 flight instructors at Saint Louis University. They were all paid a yearly salary, and their monthly income was not dependent on the number of flight hours they flew. Their instruction services included ground lessons, sim lessons, flight lessons. Typically, participants work four flight blocks per day, each two-hours long. Flight blocks began at the following times: 7:30am, 9:30am, 12:30pm and 2:30pm. Instructor schedules included a one-hour lunch break between 11:30am-12:30pm. Instructors in this sample population will shift their work hours around to accommodate out-of-block lessons, including night flights and cross country flight lessons. So, even though their work schedule is typically 7:30am CT - 4:30pm CT, with a one hour break for lunch in between, a flight instructor's schedule is subject to change to meet the needs of their flight students.

The sample size for this study was 13 participants. All participants reported being Part 141 flight instructors with total number of flight hours ranging from 200-1100+ flight hours, with experience ranging from 0 – 4+ years of flight instruction experience. More than half of respondents reported accruing more than 1100 flight hours; 23% of respondents reported 0-1 years of flight instruction experience, 23% reported 1-2 years of experience, 23% reported 2-3 years of experience, and 31% reported 4+ years of flight instruction experience. Ages among the sample population ranged from 18 – 43+, with more than half of respondents in the age range of 18-25 years. In addition to the flight instruction hours accrued during the 40-hour work week at Saint Louis University, seven respondents reported accruing between 3 – 40 additional flight hours each month outside of Saint Louis University. Survey participants were recruited through email and word of mouth within the Saint Louis University Aviation Science Department. They participated in the study voluntarily.

Survey Instrument

The survey instrument used in this study was a 31-question survey. Six of those questions were to gather demographic information about the sample population. The remaining survey questions collected data about the eating and caffeine-consumption habits of participants, hours of sleep participants got nightly, and self-reporting levels of alertness throughout the work day and across seasons.

The questions aimed to gather information about alertness cycles asked participants their alertness level, on a Likert scale of 1-4, during a given flight block within a given season. Because there are four flight blocks throughout the day in the flight department, and because there are four defined seasons (Spring: March-May, Summer: June – August, Fall: September – November, and Winter: December – February), there were 16 survey questions specifically designed to collect information about alertness levels. For that section, survey participants were provided with the following definition of alertness prior to responding to questions: “Alertness is the state of active attention by high sensory awareness such as being watchful and prompt to meet danger or emergency, or being quick to perceive and act. It is a physiological state of enhanced mental or physical performance capability.” The definition was adapted from the Merriam-Webster definition of ‘alert.’

The survey instrument was hosted on Google Forms and available for participants to respond for 48 hours. The survey instrument can be found in Appendix A.

Variables Studied

This study sought to understand changes in alertness levels over time among flight instructors within a flight training department. Time was measured in two different variables: season and flight block. Seasons were distinguished by how they fell within the calendar year, academic year and within daylight savings changes. So, because there are clock changes in St. Louis during March (spring forward to Daylight Savings Time) and in November (fall back to Standard Time), March and November were both considered as benchmark months. The remaining months of the calendar were sorted by the daylight hours of each season. Spring was set as March – May; Summer was set as June – August; Fall was set as September – November; Winter was set as December – February. Within each work day, respondents were asked to report alertness levels by the flight block: 1st Block is 7:30am-9:30am; 2nd Block is 9:30am-11:30am; 3rd Block is 12:30pm-2:30pm; 4th block is 2:30pm-4:30pm.

The dependent variable in this study was alertness level reported by each instructor. Utilizing a definition of alertness prior to survey response helped to mitigate variances in subjective understandings of alertness, and therefore, biased data sets. The goal of this study was not meant to quantify alertness among instruction staff; instead, the study sought to determine whether there were changes in perceived alertness across time among instructors. Responses were tracked utilizing a Likert scale from 1 – 4. A response of 1 indicated “not alert at all;” a response of 2 indicated “below average alertness levels;” a response of 3 indicated "above average alertness levels;" a response of 4 indicated "extremely alert." This researcher decided not to allow a response of merely "average level," so that changes in alertness level could be better tracked.

Survey Results

The survey was administered within a Part-141 flight program and received 13 total responses. The demographics of the sample population were discussed previously.

The averages of all responses were collected to better understand changes in alertness levels over time. The average was considered over the median of the data in order to better encapsulate variances in the data, since the data set was relatively small. In a larger sample population, the median response would have been utilized. But, because one more extreme response (a 1 or 4 on the Likert scale) could be reported, it served the analysis better to allow those extremes to influence the understanding of the data.

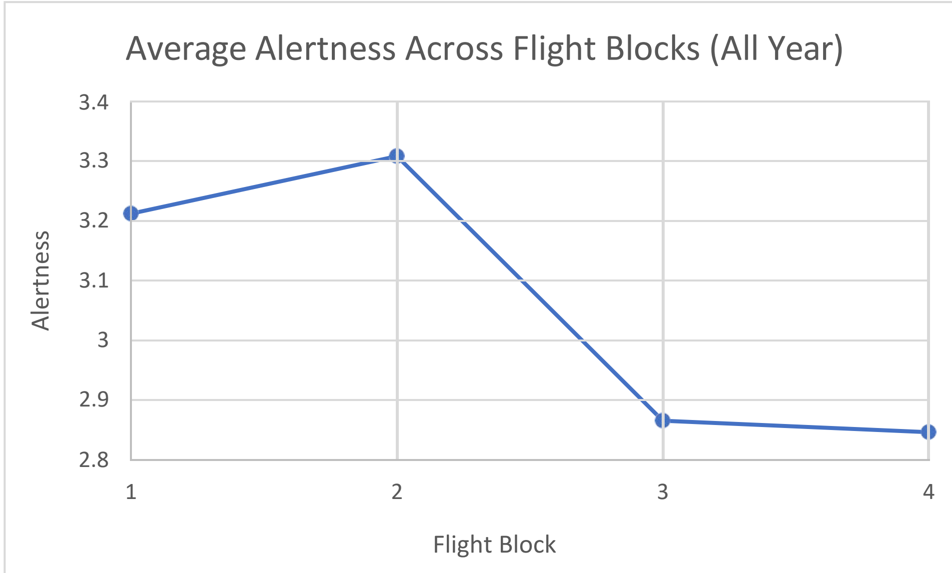
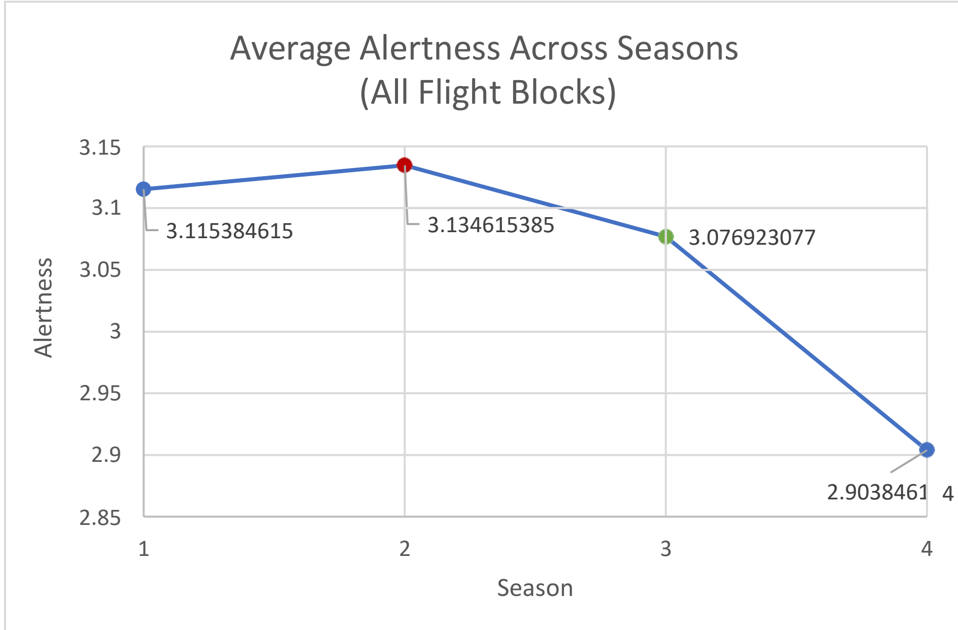


Figure 1: Average Alertness Across Flight Blocks (All Year)

Figure 1 visually demonstrates the level of alertness across flight blocks in a day. All seasons' responses were averaged for this data set. While the average level of alertness reported across all four flight blocks in a day are closer to "above average" (a score of 3) than they are closer to "below average" (a score of 2), data indicated that the flight block with highest levels of alertness among flight instructors was the 2nd flight block. Also found was that the first two blocks of the day have a higher average level of alertness than flight blocks in the afternoon. The flight block with the lowest levels of reported alertness was the fourth flight block. The change in alertness from one flight block to the next is the difference between flight block two and flight block 3. It is notable that there is a one-hour lunch break between flight block two's conclusion and the beginning of flight block three.



Season 1 = Spring (March – May)

Season 2 = Summer (June – August)

Season 3 = Fall (September – November)

Season 4 = Winter (December – February)

Figure 2: Average Alertness Across All Seasons

Figure 2 visually demonstrates the change in alertness levels across seasons of the year. On average, the sample population of flight instructors were most alert during the summer season. The sample population was least alert during the winter months, though the average score reported of 2.904 was still closer to “above average alertness” than “below average alertness.” The largest change of alertness level occurred between the winter and spring season with a jump of

2.904 to 3.115 average alertness level. The least amount of alertness level change occurred between spring and summer, with a change of 3.115 to 3.135 alertness level.

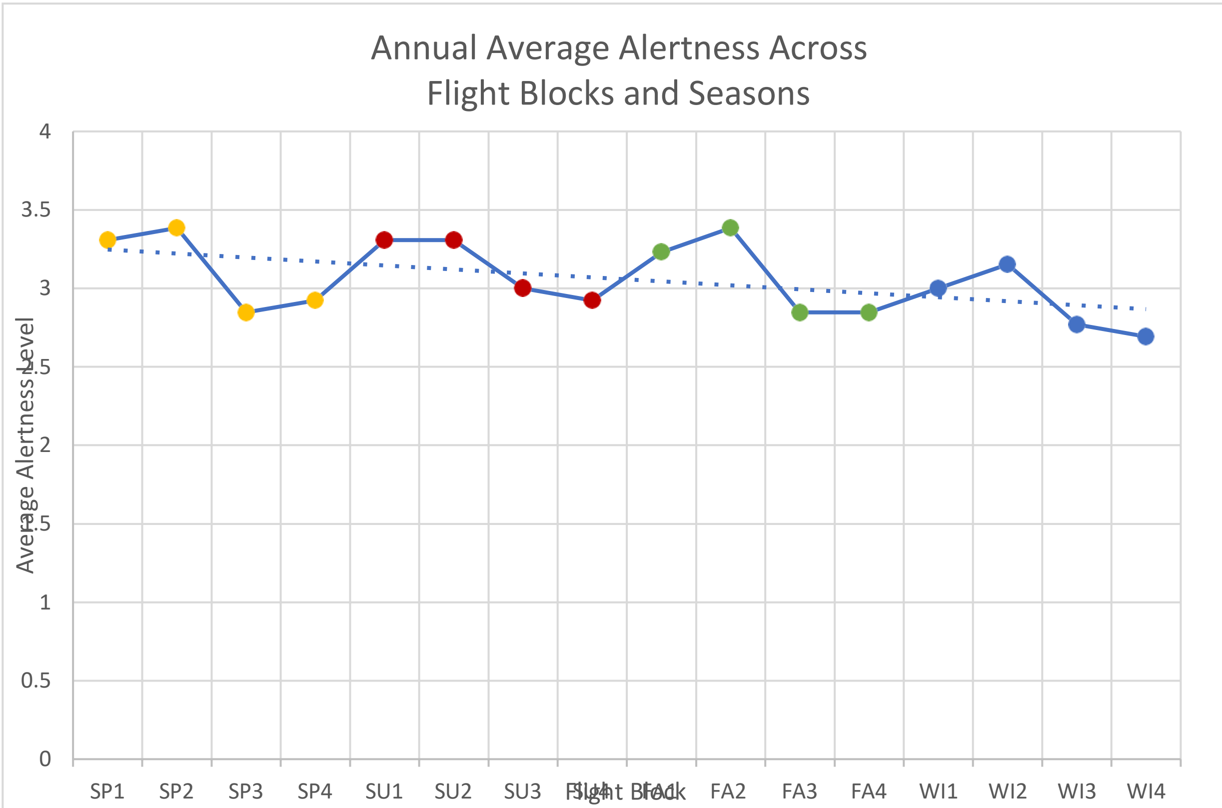


Figure 3: Annual Average Alertness Across Flight Blocks and Seasons

Figure 3 visually represents the changes in alertness levels throughout the workday and throughout the seasons, and of the visual representations of the data, communicates the most. This chart visually demonstrates the cyclical nature of alertness throughout the day, through the changing seasons. While the average alertness level through all four seasons changes through each season, the pattern of each work day in each season remains nearly the same: alertness increases from first to second block, drops significantly into third block, and declines a bit more between third and fourth block (with the exception of in fall, when average alertness remains the same between third and fourth block). There is also a trend across the four seasons (Beginning with spring, ending with winter) of a decrease in average alertness. This is demonstrated with the downward trendline.

Discussion

There are multiple goals of flight training: safely execute a flight while also teaching students to think independently and safely and accurately execute flights on their own. While a flight instructor is focusing attention toward the state of the aircraft, the phase of flight, the communications with air traffic control and dispatch, and the planning for the next stage of flight, they are also keeping track of the student and double checking all the actions of the student. In all, that is mentally taxing, maybe more so than for the commercial pilot. Thus, ensuring the flight instructor is fully engaged with their flights and engaged in their work is an imperative safety measure.

This study's results have revealed that the self-reported alertness levels among flight instructors not only vary throughout the course of the day, but also vary across seasons of the year. One notable pattern is that in the beginning of the spring months, the Midwest observes a clock schedule change by skipping an hour so there is more daylight within the work day. It is notable that the reported alertness level of winter (2.903) makes the largest seasonal jump to spring's average alertness level (3.115). Inversely, the end of daylight savings is observed in November, at the end of the fall season. From fall to winter, there is the largest average decrease in alertness level from 3.077 to 2.903. This coincides with the timing of the end of daylight savings in the Midwest, when there is a decreasing time of daylight in each day. In the depth of winter, the winter solstice near the beginning of December is the year's shortest day. Thus, a decreased level of alertness through the winter season, particularly during the fourth flight block, shows the year's lowest level of alertness. In fact, since fourth flight block ends at 4:30pm, and the earliest sunset of the year is typically about 4:30pm, it coincides that instructors would be feeling a dip in alertness at that time.

There are some of limitations to this study as well. First, the survey asked participants to remember back to their alertness levels not just during various seasons but also at different times of the day. Relying on a participant's memory, which is subjective, and for their own assessment and summary of alertness levels allows for much variability and less reliability in the reality of the alertness trends among instructors.

Additionally, all respondents work within the same flight department. While that allows for a more-level schedule structure to compare across times of day and seasons, this research did not take into account the culture of the department or other variables that may factor into alertness level during a workday. One could assume that taking the survey in the morning prior to the workday beginning would produce a different result from taking the survey at the end of an exhausting day, simply due to recency effect and skewed perception of the respondent.

Conclusion

It is interesting to find variability in perceived alertness levels among flight instructor staff. It is also interesting to find patterns across the seasons. Within the flight department, these variances should be noted and, particularly during third and fourth flight blocks and during the fall and winter season, efforts to mitigate negative ramifications of fatigue should be taken. It is useful to note that the largest dip in alertness levels occurred between second and third block, which is when this sample population had their lunch break.

Future Recommendations

First and foremost, future studies in this area should include a larger sample population to better understand patterns in alertness among flight instruction staff. It would also be interesting to include a variable about gender, to see if there are different patterns in alertness throughout the day and throughout the year between men and women. It would also be beneficial to include some level of physiological tracking in a study, like a brain waves study or breathing measurement, so data is more objective and not reliant on respondents' perception.

Additionally, given the noted pattern of alertness change between second and third block, over the lunch period, a study into the amount and quality of food consumed, as well as other lunch break behaviors, could shed light on why alertness levels drop lower after the lunch period. Determining if there are best practices instructors and the department could implement to buoy alertness levels throughout the day could better serve the safety culture of the workplace.

Resources

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Roenneberg, T., Kantermann, T., Juda, M., Vetter, C., & Allebrandt, K. V. (2013). Light and the human circadian clock. *Circadian clocks*, 311-331.

Caldwell, J. A., Mallis, M. M., Caldwell, J. L., Paul, M. A., Miller, J. C., & Neri, D. F. (2009). Fatigue countermeasures in aviation. *Aviation, space, and environmental medicine*, *80*(1), 29-59.

Appendix A

CFI Alertness Survey

Administered via Google Survey

You are invited to take part in a study that is conducted as part of an assignment for ASCI 5020: Aviation Safety Data Analysis. IRB approval is not required for this research project.

This study seeks to understand more about the relationships between alertness levels, seasons of the year, time of day, food consumption and caffeine/stimulant consumption among flight instructors at a part-141 flight program.

Your participation in this study is voluntary, and you can withdraw at any time. The survey should take no more than 10 minutes.

The following survey will ask you a series of questions, to which you'll respond using a Likert scale (1-4 scale). Your responses will remain anonymous and confidential. It is not anticipated that you will experience any risk greater than normal daily activities as a result of your participation in this study. Please respond to questions as accurately as you are able with the statements provided.

This research is conducted for educational purposes only, and the findings will not be disseminated outside the classroom environment.

By completing this survey, you acknowledge and agree to the information above.

Please email amy.preis@slu.edu & jon.martin@slu.edu for any questions.

1. I am a certified flight instructor at a part-141 flight school.
   a. Yes
   b. No
2. My total number of flight hours:
   a. 200-500
   b. 501-800
   c. 801-1100
   d. More than 1100
3. My total number of years of flight instruction experience:
   a. 0-1 Years
   b. 1-2 Years
   c. 2-3 Years
   d. 4 + Years
4. My age:
   a. 18-25
   b. 26-33
   c. 34-42
   d. 43 and older

5. My weekly schedule:
    a. Monday-Friday
    b. Tuesday-Saturday
6. On average, I accrue this many flight hours outside of Parks College each month (optional):
    a. Fill in the blank:
7. Please indicate whether or not you use caffeine or consume products containing caffeine in order to increase alertness during the work day
    a. Yes, I typically consume caffeine/ caffeinated products
    b. No, I do not typically consume caffeine/ caffeinated products
8. If you consume caffeine, please indicate how often in a given work week
    a. 1-3 times a week
    b. 4-6 times a week
    c. 7 or more times a week
    d. Not applicable
9. When consuming caffeine, I do so prior to or during (select all that apply):
    a. First block
    b. Second block
    c. Lunch
    d. Third block
    e. Fourth block
    f. Not applicable
10. For any given night, I sleep about
    a. 4-5 hours
    b. 5-6 hours
    c. 6-7 hours
    d. More than 7 hours
11. Based on the average intake of roughly 500-700 calories per meal, during the average work day, I eat:
    a. One meal
    b. Two meals
    c. Three meals
    d. Four or more meals
12. During the work week, I usually consume snacks
    a. Never
    b. Sometimes
    c. Often

d. Daily

13. I would rate my eating habits of healthy food as
    a. Poor
    b. Fair
    c. Good
    d. Excellent
14. How many times a week do you eat fast/fried food/or packaged snacks high in fat/salt/or sugar?
    a. 1-2
    b. 3-4
    c. 5-6
    d. 7 or more
15. How many servings of fresh, canned, frozen or dried vegetables did you eat each week?
    a. 0-4 servings
    b. 4-8 servings
    c. 9-12 servings
    d. 13 or more servings

Definition of Alertness: Alertness is the state of active attention by high sensory awareness such as being watchful and prompt to meet danger or emergency, or being quick to perceive and act. It is a physiological state of enhanced mental or physical performance capability.

16. During the spring months, (March-May), my level of alertness during the FIRST flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
17. During the spring months, (March-May), my level of alertness during the SECOND flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
18. During the spring months, (March-May), my level of alertness during the THIRD flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert

   d. 4 - Extremely alert
19. During the spring months, (March-May), my level of alertness during the FOURTH flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
20. During the summer months, (June-August), my level of alertness during the FIRST flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
21. During the summer months, (June-August), my level of alertness during the SECOND flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
22. During the summer months, (June-August), my level of alertness during the THIRD flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
23. During the summer months, (June-August), my level of alertness during the FOURTH flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
24. During the fall months, (September-November), my level of alertness during the FIRST flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert
    c. 3 - Above average alert
    d. 4 - Extremely alert
25. During the fall months, (September-November), my level of alertness during the SECOND flight block is:
    a. 1 - Not at all alert
    b. 2 - Below average alert

   c. 3 - Above average alert
   d. 4 - Extremely alert
26. During the fall months, (September-November), my level of alertness during the THIRD flight block is:
   a. 1 - Not at all alert
   b. 2 - Below average alert
   c. 3 - Above average alert
   d. 4 - Extremely alert
27. During the fall months, (September-November), my level of alertness during the FOURTH flight block is:
   a. 1 - Not at all alert
   b. 2 - Below average alert
   c. 3 - Above average alert
   d. 4 - Extremely alert
28. During the winter months, (December-February), my level of alertness during the FIRST flight block is:
   a. 1 - Not at all alert
   b. 2 - Below average alert
   c. 3 - Above average alert
   d. 4 - Extremely alert
29. During the winter months, (December-February), my level of alertness during the SECOND flight block is:
   a. 1 - Not at all alert
   b. 2 - Below average alert
   c. 3 - Above average alert
   d. 4 - Extremely alert
30. During the winter months, (December-February), my level of alertness during the THIRD flight block is:
   a. 1 - Not at all alert
   b. 2 - Below average alert
   c. 3 - Above average alert
   d. 4 - Extremely alert
31. During the winter months, (December-February), my level of alertness during the FOURTH flight block is:
   a. 1 - Not at all alert
   b. 2 - Below average alert
   c. 3 - Above average alert
   d. 4 - Extremely alert

Thank you for completing this survey!

Appendix B

Survey Responses – Questions About Alertness Across Seasons (questions 16-31)

During the spring months, (March-May), my level of alertness during the FIRST flight block is:	During the spring months, (March-May), my level of alertness during the SECOND flight block is:	During the spring months, (March-May), my level of alertness during the THIRD flight block is:	During the spring months, (March-May), my level of alertness during the FOURTH flight block is:
3	3	3	3
2	3	3	3
4	4	3	4
3	4	2	2
3	3	3	3
4	4	3	3
4	3	3	2
3	3	2	3
3	3	2	2
4	4	4	4
3	3	2	3
3	3	3	2
4	4	4	4

During the summer months, (June-August), my level of alertness during the FIRST flight block is:	During the summer months, (June-August), my level of alertness during the SECOND flight block is:	During the summer months, (June-August), my level of alertness during the THIRD flight block is:	During the summer months, (June-August), my level of alertness during the FOURTH flight block is:

3	3	3	3
2	2	2	2
4	4	3	3
3	2	2	2
3	3	3	3
4	4	3	3
4	4	4	3
2	3	3	3
3	3	2	2
4	4	4	4
4	4	3	4
3	3	3	2
4	4	4	4

During the fall months, (September-November), my level of alertness during the FIRST flight block is:	During the fall months, (September-November), my level of alertness during the SECOND flight block is:	During the fall months, (September-November), my level of alertness during the THIRD flight block is:	During the fall months, (September-November), my level of alertness during the FOURTH flight block is:
3	3	3	3
3	3	3	3
4	4	4	3
3	4	2	2
2	3	3	3

4	4	3	3
3	3	2	2
3	3	2	3
3	3	2	2
4	4	4	4
3	3	2	3
3	3	3	2
4	4	4	4

During the winter months, (December-February), my level of alertness during the FIRST flight block is:	During the winter months, (December-February), my level of alertness during the SECOND flight block is:	During the winter months, (December-February), my level of alertness during the THIRD flight block is:	During the winter months, (December-February), my level of alertness during the FOURTH flight block is:
3	3	3	3
2	2	2	2
4	4	4	4
3	4	3	2
2	3	3	3
4	4	3	3
3	2	2	1
2	3	2	3
3	3	2	2
4	4	4	4
2	2	1	2
3	3	3	2

	4	4	4	4

Archival Research – Sample Student Work

1. Investigation on Go-Arounds and Missed Approaches

Introduction

With the advancement of technology in aviation, safety has become a higher priority, and everyone expects to see fewer accidents/incidents. While the investment of technology into aviation has been impressive, it can inadvertently cause secondary issues such as pilot proficiency or even impede proper pilot decision making. From the beginning of flight training, students are taught that whenever there is a doubt regarding the outcome of the approach, a go-around/missed approach should be executed with safety primarily in mind. The Federal Aviation Administration (FAA) defines a go-around/missed approach as terminating a landing approach. If a go-around/missed approach procedure is performed correctly, then there is a reduced likelihood of an accident/incident occurring. Unfortunately, many pilots are resistant to this procedure because they may be seen as 'weak' or not a good pilot. Along with this, these procedures and maneuvers become rarely practiced as pilots progress in their career. Looking at pilots with Airline Transport Pilot (ATP) ratings, these professional pilots very rarely perform these maneuvers. In fact, these maneuvers are often only practiced once a year in the simulator or on the rare occurrence in the aircraft. Because of the lack of practice/proficiency commercial airline pilots have, they may be more prone to errors then a private pilot who conducts them often.

The purpose of this archival research is to study the reasons and potential factors that contribute to an increased likelihood of accidents/incidents during go-around/missed approaches. This critical phase of flight was researched by pulling data from the FAA and the National Transportation Safety Board (NTSB) websites, as well as researching related articles previously published in industry accepted academic journals. The statistics and written reports provided from these data sources allow interpretation and determination of areas which should be further investigated to potentially prevent similar accidents/incidents in the future.

Case Study Background

In aviation, and especially in commercial jet aviation, "the final-approach phase is one of the most dynamic flight segments, for which safety margins are minimum and time pressure is maximum" (Dehais et al., 2017, p. 15). There are so many critical items occurring at the same time where the pilot flying (PF), and pilot monitoring (PM) must have exceptional situational awareness (SA). During this phase of flight when a go-around/missed approach is executed, "the PF's task is to manage the missed-approach flight path while giving instructions to the PM (e.g., retracting the flaps and the landing gear). The PM carefully monitors the flight path and the status of the aircraft and executes the PF's instructions" (Dehais et al., 2017, p. 15).

The fact that pilots fail to properly execute a go-around/missed approach, or even execute one at all, is widely acknowledged within the aviation community. Often, pilots push an approach or landing past an acceptable safety margin and end up putting themselves and their aircraft in an exposed situation. A stabilized approach is an approach where the pilot can maintain a constant angle glidepath towards a predetermined point on the landing runway. Many airlines or professional pilots have certain criteria they must meet by 1,000 feet height above threshold (HAT). For example, I currently have several approach criteria which must be satisfied to continue the approach past the 1,000 feet HAT. This criterion is:

- On lateral and vertical profile
- Airspeed within -0 and +10 kt of approach speed
- Thrust levers above idle
- Sink rate is no greater than 1,000 ft/min; if an approach requires a high sink rate, a briefing is required
- The aircraft must be fully configured for landing and the BEFORE LANDING CHECKLIST complete

Airlines have historical knowledge and data which shows pilots continuing an approach even though it is classified as unstable. Most airlines will track this data and determine how many unstable approaches are continued even though unstable approach criteria have been met. When, and if, aircrews decide to execute a go-around/missed approach, they have already gone past an acceptable safety margin which makes the maneuver even more difficult. Because "turbine engines have longer engine response (spool up) times compared with their piston-counterparts," delaying the maneuvers execution can have tragic results (Boyd & Stolzer, 2016, p. 210).

The point I'm trying to make is that go-arounds/missed approaches are not executed at the rate they probably should be. No pilot, regardless of their experience, is immune to making mistakes during these procedures. Also, because this maneuver is not conducted at the rate they should be, proficiency then becomes a problem with these maneuvers and poses a threat to aircrews and everyone on board.

Databases

The data utilized for this archival study has been retrieved from primarily two aviation databases. The first database utilized is the FAA Accident and Incident Data System (AIDS) database which can be found under the FAA Aviation Safety Information Analysis and Sharing (ASIAS). This database is formerly known as FAA Office of System Safety (NASDAC). Data which is pulled from the AIDS database is technically classified as an incident. "Incidents are events that do not meet the aircraft damage or personal injury thresholds contained in the NTSB definition of an accident" (ASIAS, 2021). Reports found within the AIDS database are those which are not investigated by the NTSB.

The second database utilized is the NTSB Aviation Accident Database and Synopses (ACD) database. ACD "contains information from 1962 and later about civil aviation accidents and selected incidents within the United States, its territories and possessions, and in international waters" (ACD, 2021). This database is an important tool to look deeper into accidents/incidents because the report eventually has "a final description of the accident and its probable cause" (ACD, 2021).

The data collected from these two databases is diversified in a range of dates. The AIDS database was utilized with the most recent data they had from 1978 to 2008. The NTSB ACD databased was utilized with the most recent data they had from 1962 to 2021. The data pulled and their implications on go-around/missed approach mishaps will be discussed further later in this paper.

Methodology

Procedure

Initially, an academic journal/article search was conducted to establish a better understanding of the problem with go-around/missed approaches. Due to the many facets of this dynamic maneuver and the problems which could potentially be associated with it, a determination had to be made to determine which direction to go in. Since much of the academic research has gone over the reasons for the problems, I chose to look at the raw data instead.

By extracting the raw statistical data from the AIDS and ACD databases, a first look was given at some statistics. As previously mentioned, the AIDS statistical data is pulled from the years between 1978 and 2008 while the ACD statistical data is pulled from the years between 1962 and 2021. The statistics of interest from this data were the type of aircraft operation, total PIC hours, total PIC hours in model, amount of aircraft damage, and total injuries. The data which was extracted focused on two phases of flight: go-around during visual flight rules (VFR) conditions and missed approaches during instrument flight rules (IFR) conditions.

After the data was extracted from the databases, it was inputted into excel format where the data could be sorted and evaluated. I attempted to determine if there was any sort of correlation which may indicate a higher probability of an accident or incident occurring if certain criteria were met.

Results Obtained

Through researching the AIDS and ACD databases, there are common factors which may lead to a higher probability of an accident/incident occurring during a go-around/missed approach.

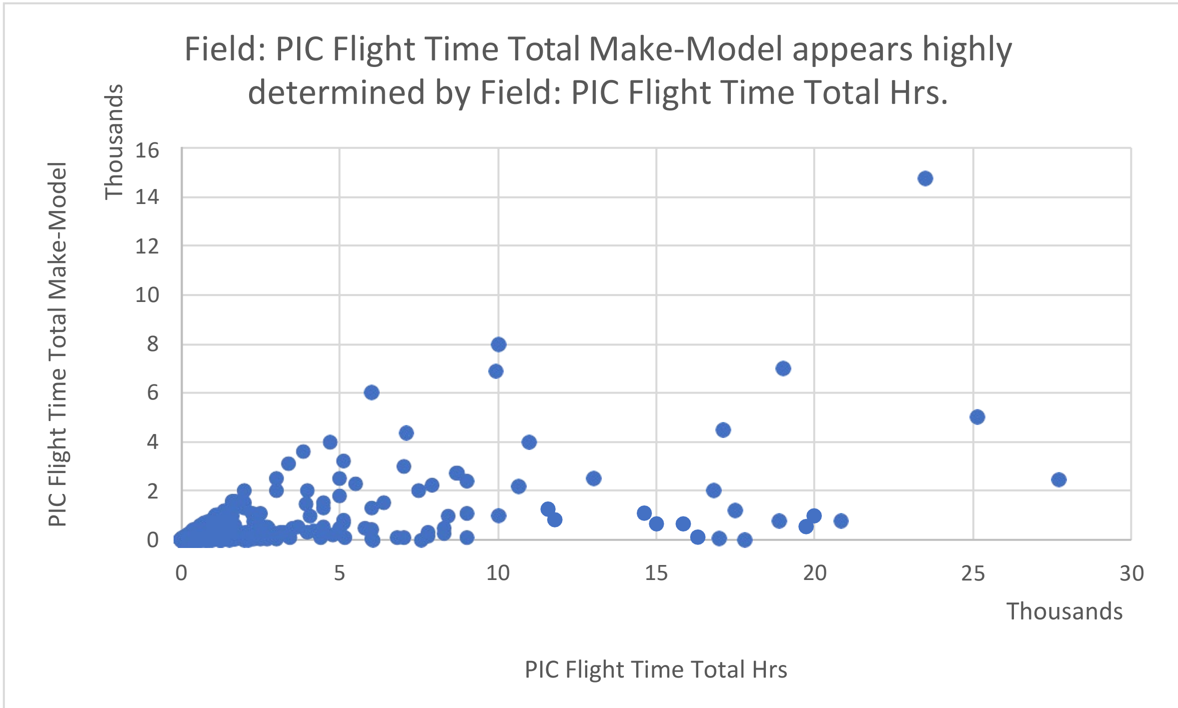

Figure 1: PIC Flight Time Total Make-Model vs PIC Flight Time Total

Figure 1 shows a comparison of PIC flight time in make and model vs PIC flight time total. There is an interesting correlation from the data which show an abnormal number of accidents/incidents occurring with pilots who have less then 3,000 total PIC hours and less then 2,000 total PIC in make and model hours. While there are still multiple accidents/incidents occurring with pilots who have less then 5,000 total PIC hours, the majority does appear to be less then 3,000 total PIC hours.

Figure 2: Primary Flight Type During VFR Go-Around

Figure 2 shows the primary flight type the flight was operating under during the accident/incident. It is somewhat surprising that most accidents/incidents occur during personal flight type rather than instruction. After personal and instruction flight type, ‘professional’ flight types appear to have a consistent number of accidents/incidents between 10 and 20 occurrences.

Figure 3: Primary Flight Type During VFR Go-Around Injury Incident

Figure 3 shows the primary flight type during an injury occurrence. This dataset is one I expected with personal being much higher than instruction. The primary reason one can extrapolate this is that instructors are trained to identify and rectify issues early and often. With a trained instructor in the aircraft, it is more likely that an error can be corrected before it progresses too far and results in an accident/incident.

Count of Primary Flight Type	**Column Labels**				
Row Labels	**MINOR**	**SUBSTANTIAL**	**DESTROYED**	**NONE**	**Grand Total**
PERSONAL	243	8	1		252
INSTRUCTION	75	2			77
BUSINESS	19				19
AIR TAXI (NON-SCHEDULED)	13	1			14
INDUSTRIAL/SPECIAL	8				8
OTHER	8				8
AIR TAXI (SCHEDULED- NOT COMMUTER)	5				5
SCHEDULED AIR CARRIER	5				5
AIR TAXI COMMUTER (SCHEDULED 5 OR MORE ROUNDTRIPS PER WEEK)	3				3
FOR HIRE	2			1	3
AERIAL APPLICATOR	3				3
EXECUTIVE	3				3
ALL CARGO CARRIERS	2				2
(blank)					
Grand Total	**389**	**11**	**1**	**1**	**402**

Figure 4: Type of Aircraft Damage During VFR Go-Around

Figure 4 shows the type of aircraft damage that occurs during the accidents/incidents. This dataset is somewhat surprising because I expected more substantial or destroyed numbers. The reason I expected higher numbers is because go-around/missed approaches are usually conducted less than 1,000 feet HAT and allows for minimal amount of time to correct any errors. Due to this, controlled flight into terrain (CFIT) is a highly likely possibility which has catastrophic results.

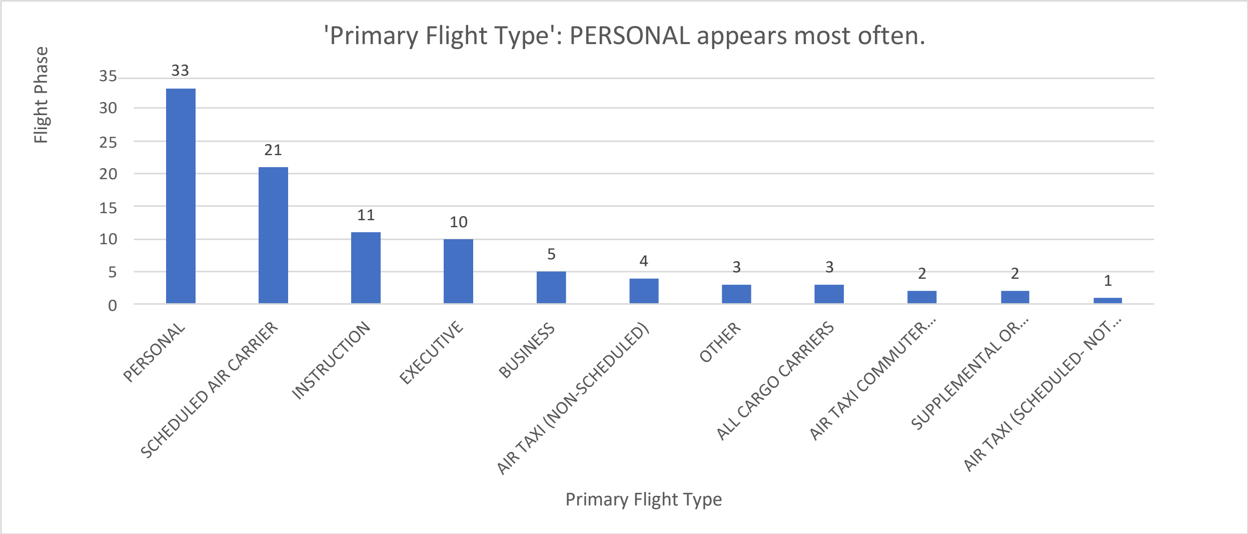

Figure 5: Primary Flight Type During IFR Missed Approach

Figure 5 shows the type of flight which was being executed when the IFR missed approach was performed. It is not surprising that scheduled air carrier operations are second since they often operate in IFR conditions on a regular basis. It is somewhat surprising that there are as many as personal flight types because many pilots tend to stay home on bad weather days.

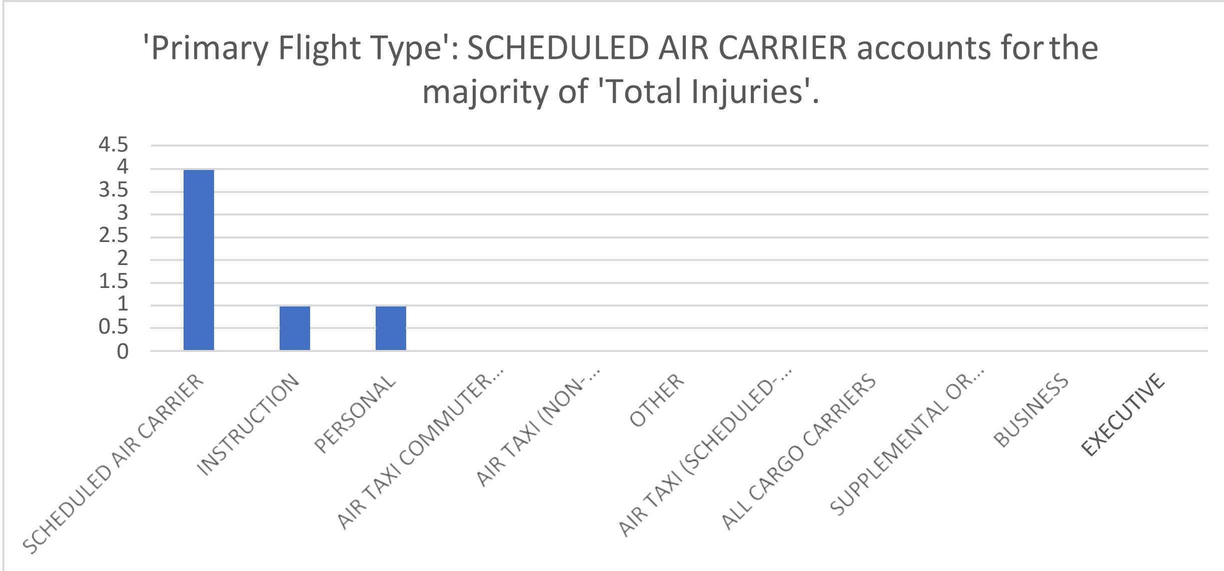

Figure 6: Primary Flight Type During IFR Missed Approach Injury Incident

Figure 6 shows the number of injuries resulting from an IFR missed approach not being executed properly. Scheduled air carriers are most likely higher since they tend to carry more passengers. I did expect to see the numbers higher than they are though.

Conclusion

Although many of these previously discussed factors and problem with go-arounds/missed approaches are widely known within aviation, they still routinely occur. Because of this, aviation organizations need to approach the problem from a different viewpoint. Through the analysis of data, there is a possibility that certain controls can be put in place. While training may not be able to alleviate 100% of these occurrences, avoiding high risk pairings could potentially reduce the occurrences to an acceptable level.

The major conclusion which I drew from this was the hour range and primary flight type where pilots were most at risk for having an issue during go-around/missed approach procedures. When pilots have less then 2,000 total hours PIC in make and model and less than 3,000 total hours, they are at a higher risk for having an accident/incident. Airlines can try and take this information by avoiding crew pairings where both pilots have less then 2,000 hours in make and model.

While we can never eliminate aviation accidents/incidents, we can try and implement controls to mitigate their occurrence. Often, airlines will say they are implementing controls, but they aren't effective. With all the raw statistical data available, airlines need to start looking at different ways to combat complacency. Emphasizing these facts to crews who may be in a low hour situation could potentially keep them more aware while they are flying. Presenting this type of data to aircrews when they go through continuing qualification every year could also be a way to make them more aware of the hazards. Overall, this is an area which I believe deserves more attention than it currently receives.

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2. Investigation of Fatigue Related Aviation Accidents 1980-2021

Introduction

Human fallibility within aviation accidents is identified through an in-depth analysis of Human Factors. Pilot fatigue is a symptom of such fallibility and can be caused by cognitive or medical psychological disorders. The cognitive psychological issues can stem from sleep hygiene or circadian dysrhythmia, whereas medical problems such as obstructive sleep apnea and insomnia require professional medical intervention (Antuñano & Brown; Newsom, 2020). The consequences of these sleep issues leads to a lack of quality rest for flight crews, and subsequently, public safety is compromised due to degraded pilot performance and an increased percentage of accidents caused by fatigued flight crews. Roughly 21% of aviation accidents are related to pilot fatigue (Jackson & Earl, 2006). The purpose of this study is to identify trends in aviation accidents related to pilot fatigue from 1980 to December of 2021 in order to increase pilot and passenger safety, reduce aviation accidents or incidents, and improve pilot performance, restfulness, and overall health.

Case Study Background

Fatigue has been widely studied, but the most prevalent accident related to fatigue in the United States occurred in 2009 when Colgan Air Flight 3407 crashed in New York. Industry-standard commuting and intolerable rest policies led two pilots to fly into icing conditions through the night, and they did not have the wherewithal to handle the compounding issues (NTSB, 2010). Additionally, another incident related to fatigue occurred a year before in Hawaii in February of 2008 when both pilots of a CRJ-200 aircraft fell asleep and flew off course by 26 miles. The captain of Mesa Airlines Flight 1002 suffered from an undiagnosed obstructive sleep apnea (Hradecky, 2008). Fortunately for the crew, passengers, and civilians on the ground, no one was injured because the pilots awoke after sleeping for 18 minutes. Surprisingly, the flight crew immediately discussed the event with the FAA, but instead of grounding themselves for fatigue, they were determined to continue on to their final destination because, “they'd be very alert due to the incident and decided to perform the flight” (Levin, 2008; Hradecky, 2008). A 2003 research project highlighted the exact issues that led to both of these occurrences. Goode postulated that fatigued pilots were significantly at risk of accidents and that extended duty times must be diligently considered; moreover, their results show a relatively constant increase of risk with increased length of work periods (Goode, 2003).

Databases

Data were collected from the National Transportation Safety Board’s (NTSB) Aviation Accident Database & Synopses. This study intended to identify trends of modern fatigue problems. Therefore, the specific data were retrieved by limiting the event dates from January 1st, 1980 to December 10th, 2021. Additionally, the data were filtered by specifically searching for “Pilot Fatigue.” This narrowed down the available accidents or incidents to 56 cases related to pilots feeling the effects of fatigue.

Methodology

Procedure

Fatigue in the aviation industry has been diligently documented by the National Transportation Safety Board. The NTSB's Aviation Accident Database has detailed aggregate data surrounding many aviation accidents and incidents, and because of this, their database was rife with helpful data points surrounding fatigue-related events. Once data were collected from each report, they were entered into a Google Sheets SpreadSheet and graphically analyzed. Due to two vital data points not being included in the original XML file, manual data entry was required in order to analyze the variables of Time of Day and Pilot Total Flight Time. Once the graphics were compiled, they were then organized for further analysis.

Results obtained

Fatigue was found to be a contributing or causal factor in 56 accidents and incidents in the United States from the period between January 1st, 1980 to December, 10th, 2021. It is important to distinguish between accidents and incidents. Accidents are occurrences associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage (FAA, 2021). Aircraft Incident means an occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations (FAA, 2021). In the collected data set, 55 occurrences were aircraft accidents and 1 was an aircraft incident. The following graphs depict substantial information that can be used to identify many interrelated variables. A graphical representation of the location of each accident and incident is included for reference.

Figure 1: Locations of Non-Fatal Accidents Related to Fatigue in the U.S.

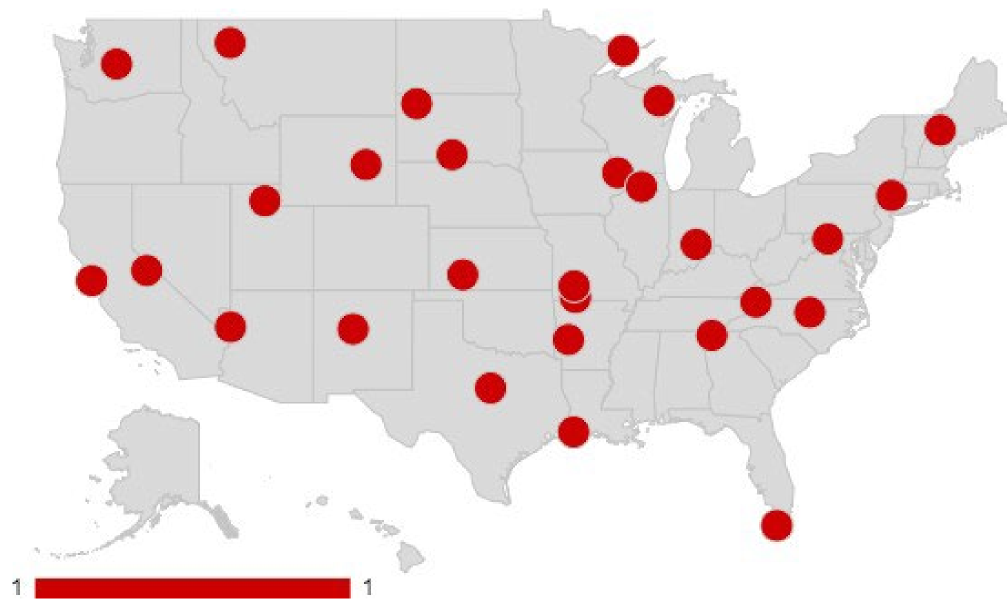

Figure 2: Locations of Fatal Accidents Related to Fatigue in the U.S.

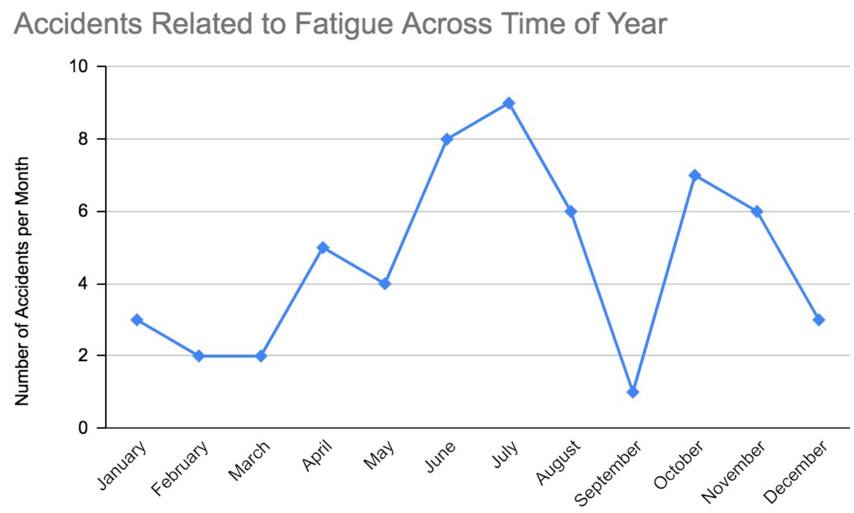

Figure 3. Accidents related to Fatigue Across Time of Year

Figure 3 shows the frequency of aircraft accidents related to fatigue based on the time of year each accident occurred. This data could potentially be linked to better flying conditions throughout the spring and summer months which would increase pilot duty times. When weather is more stable throughout the summer, missions may require pilots to push longer work days and exert themselves more than on days where flying is slower.

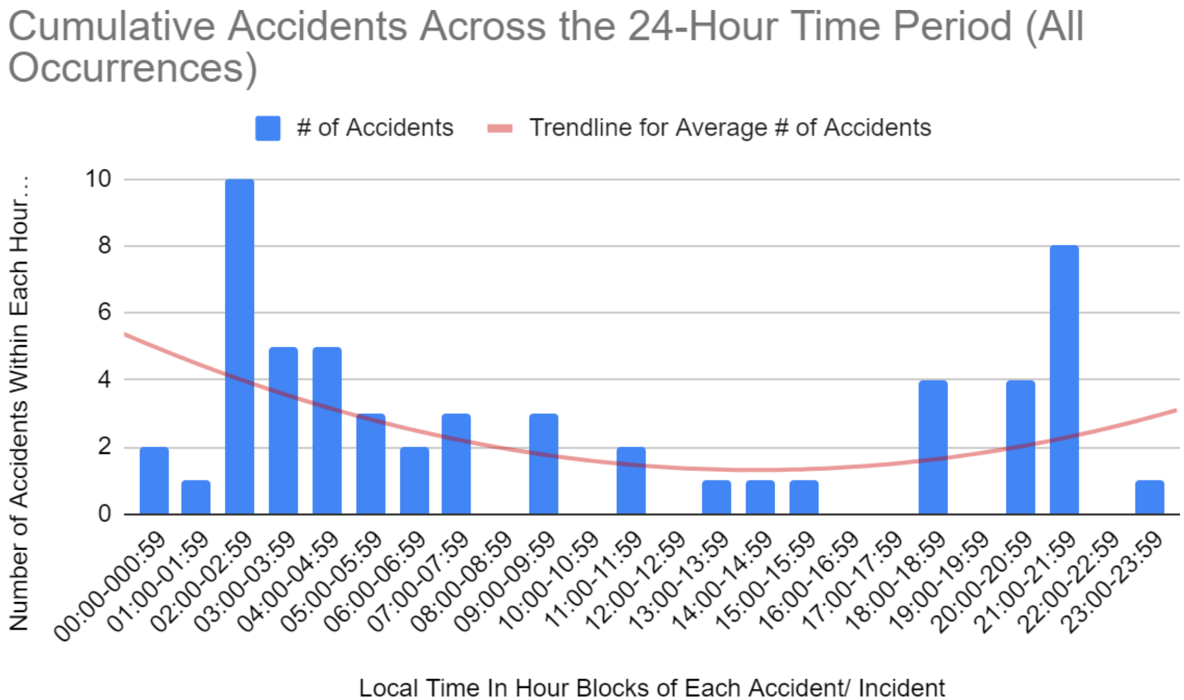

Figure 4: Cumulative Accidents Across the 24-Hour Time Period (All Occurrences)

The human brain has evolved to relax after dark, and even sleep will not fully compensate for the body's natural reaction to night time. This notion is referred to as circadian misalignment which can lead to dangerous situations if not mitigated (Price, 2011). As depicted in the chart, it is quite evident that most accidents related to fatigue occur during times of low or no daylight.

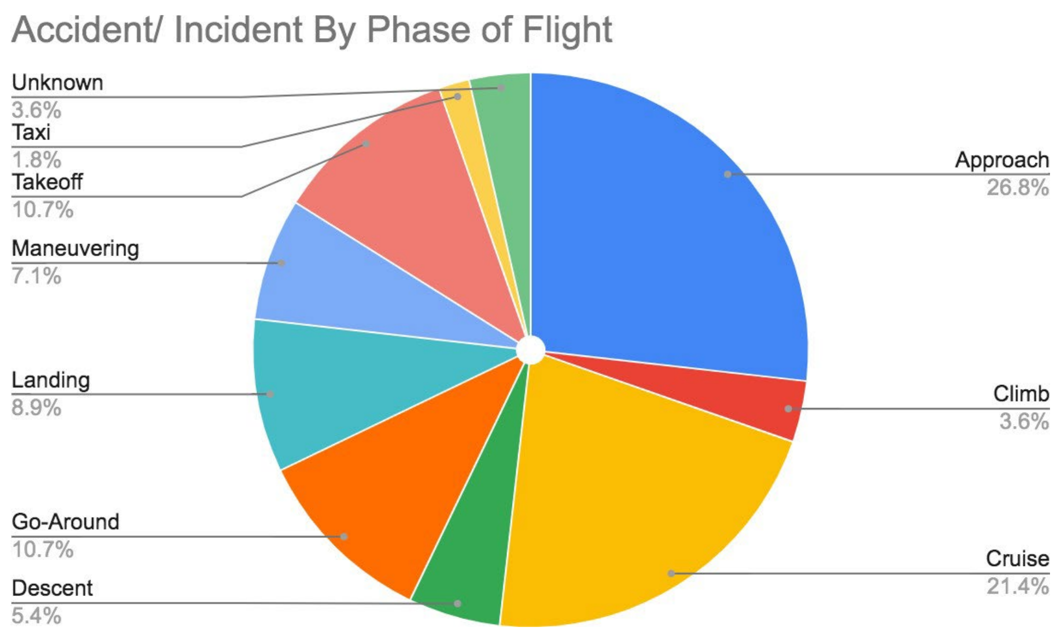

Figure 5: Accidents and Incidents By Phase of Flight

Each phase of flight requires varying levels of alertness. The purpose of this chart is to show how every phase of flight can be impacted by fatigue and lead to pilot error. Critical phases of flight such as takeoff, approach, landing, and go-arounds require diligent focus and alertness, and that increased focus can be extremely taxing on the pilot's mental acuity for complete situational awareness. It is not surprising to find that accidents related to fatigue have occurred in cruise flight as that can be a relaxed state for flight crews.

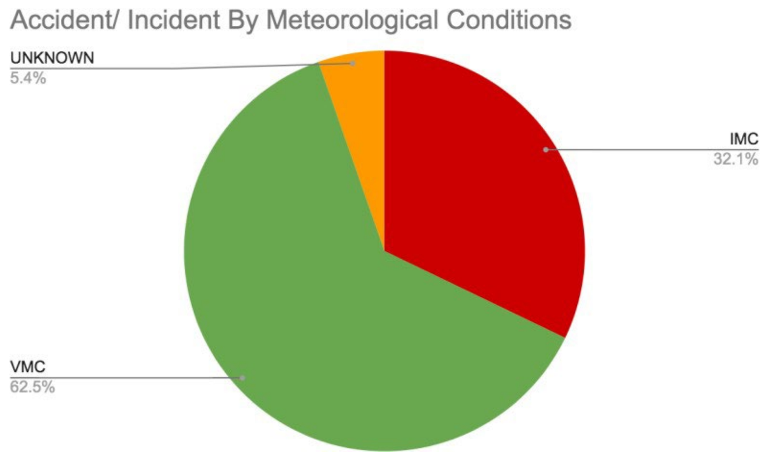

Figure 6: Accidents and Incidents By Meteorological Conditions

While Visual Meteorological Conditions, known as the weather condition of being able to rely on outside visuals rather than solely upon flight instruments, might prevail when flying at night, night illusions can increase the feeling of fatigue. Empty-Field Myopia is a common condition where eyesight has nothing to focus on and causes the pilot to relax their vision (FAA). This relaxation of the vision can lead to loss of focus, and pilots can succumb to the effects of fatigue

Flying in Instrument Meteorological Conditions increases fatigue due to the extremely high mental workload. This causes acute mental fatigue due to the amount of focus required for the tasks at hand, and this fatigue compounded with any sleep disorder can be difficult to overcome (Novacek, 2003).

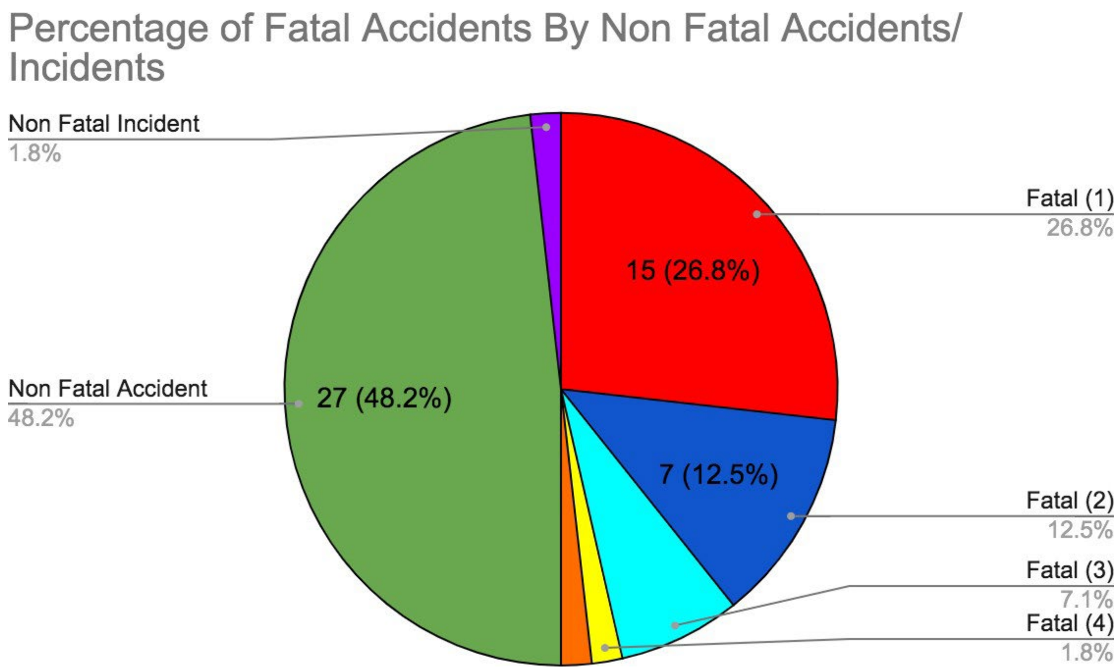

Figure 7: Percentage of Fatal Accidents By Non Fatal Accidents and Incidents

Figure 7 shows the number of fatal accidents equals the number of non-fatal accidents and incidents and how the severity of fatal accidents can be broken down between the amount of fatalities suffered from each accident. It should be noted that the unnamed data point comes from an accident with six fatalities.

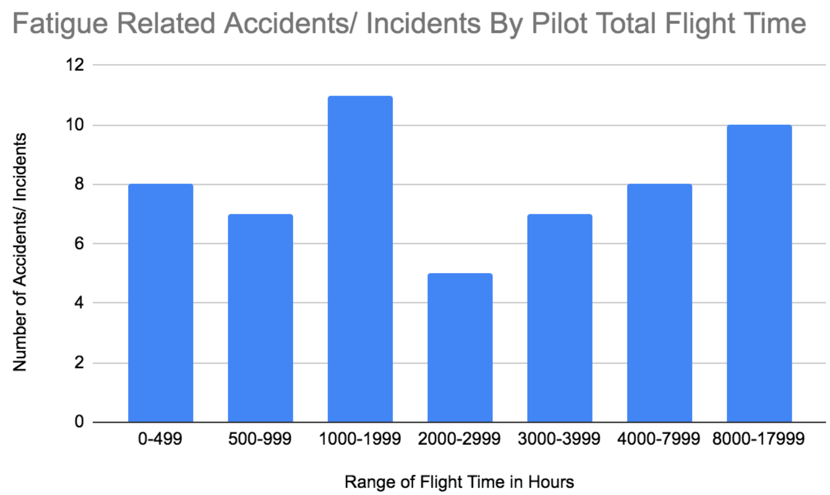

Figure 8: Fatigue Related Accidents and Incidents By Pilot Total Flight Time

The categories of flight time were divided with the restriction of succinctness within the chart. Additionally, it was the author's interpretation that flight experience gained between 4,000-7,999 and 8,000-17,999 was as impactful as the experience gained from 0-499, 500-999, and the 1,000 hour intervals thereafter.

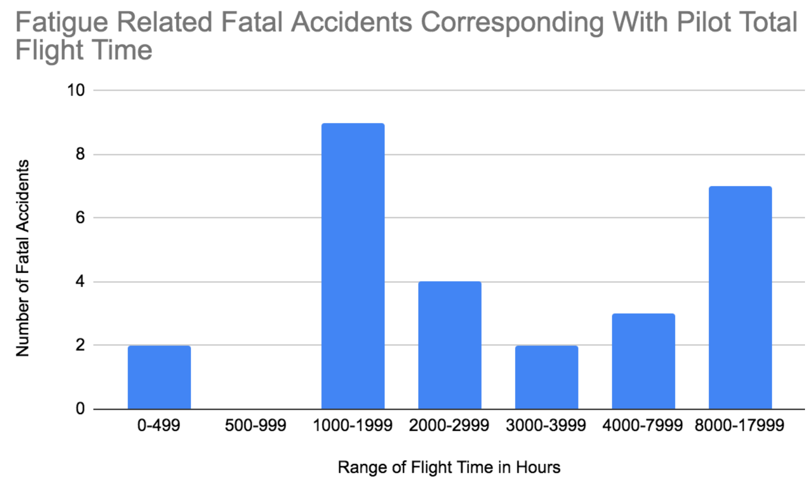

Figure 9: Fatigue Related Fatal Accidents Corresponding With Pilot Total Flight Time

This graph represents the potential association between poor aeronautical decision making and experience. Hazardous attitudes such as "Macho" and "Invulnerability" can cloud a pilot's judgement and make them think that they are impervious to hazards. Furthermore, fatigue leading up to the decisions made by these individuals could have contributed to the pilots continuing into the unsafe situation against their normal judgement.

Discussion and Future Recommendations

This archival research study uncovered important data points regarding accidents and incidents related to fatigue. Identification of such data allows a thorough understanding of many variables such as flight through the night, attentiveness throughout every phase of the flight, avoiding fatigue related complacency due to VMC conditions, and resisting hazardous attitudes that could cloud aeronautical decision making. Learning from mistakes is essential with aviation, and an industry that learns from mistakes relating to fatigue will cause a stronger, safer environment for pilots and the general public.

Future Recommendations

There are several recommendations for future archival and field research similar to this study. Firstly, this study did not focus intently on compounding variables. Figure 4 does not account for pilot duty times and time awake. These compounding variables can greatly affect the pilot's ability to fly throughout the day. If a pilot flew many hours or did not get an appropriate amount of sleep, the time of day may have heightened the feeling of fatigue caused by those aforementioned issues. Also, future research should include an emphasis on complex, high-performance, and multi-engine aircraft involved with fatigue-related accidents and incidents.

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Graduate Course Performance Indicator Rubric

Assess Student Learning Outcomes

Course: ASCI 5220 Aviation Safety Programs Course Instructor:_____Janice McCall____

Semester Taught:_____Fall 2021__________ Number of Students in Course:____3___

Student Learning Outcome Assessed	Assessment Results: (Indicate what % of class achieved a minimum score of 80%)	Benchmark achieved? (Benchmark: 80% of students will score a minimum of 80% = "B")
SLO 1: Assess relevant literature or scholarly contributions in the aviation field of study.	100%	Yes
SLO 3: Apply knowledge from the aviation field of study to address problems in broader contexts.	100%	Yes

Course Assessment (Intended Use of Results)
The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

**Attach description of assignment used for assessment and samples of student work.*

SLO 1: Assess relevant literature or scholarly contributions in the aviation field of study.

Module 3 - Canvas Written Assignment (Paper #3):
Complete a 3-5 page paper on one of the topics listed below.

- Non-Punitive/ Voluntary Reporting Systems
- Aviation Quality Programs (FOQA)
- Just Culture

Formatting and submitting the paper

- Use the short paper format in "Course Resources."
- Follow APA 7th style by appropriately quoting, citing, and referencing sources. Writing resources are also available in the "Course Resources."
- Submit your paper by uploading it to this assignment. If you have any problems attaching the paper you may email it to jan.mccall@slu.edu prior to the due date and time.
- Due NLT midnight on 24 OCT 2021, 11:59 pm CST.

Points Possible: 100

Due Date: 24 October 2021

Notification thru: Schedule, Module Lesson Plan, Discussion, Presentation, Email, Announcement

Submission: attached as Word or PDF documents to assignment link

Guidance and resources: Module Lesson Plan, Lecture, Directed Reading of the textbook, Optional Reading of short article, Instructions/Steps to success, sample paper, weblinks SLU Graduate Writing Center and Purdue OWL APA.

Student Submission: Zoe Madigan

Note: *There may be sloght formatting differences as this document was converted from PDF.*

[redacted]
ASCI 5220
31 October 2021

Aviation Quality Programs

Established in 2004 by AC (Advisory Circular) 120-82, FOQA (Flight Operational Quality Assurance) FDM (Flight Data Monitoring) uses aggregate data provided by airlines to the FAA that "will be kept confidential and the identity of reporting pilots or airlines will remain anonymous as allowed by law" (FAA, 2004, p. 1). The purpose of FOQA is for the FAA to be able to gather safety data without compromising the anonymity of any individual pilots or airlines. From this data, the FAA intended to make data analyses in order to improve safety and make discoveries about incidents in order to fix and reduce them. Protections are pursuant to Title 14 (14 CFR), part 193 indicating that, “Information submitted to the FAA pursuant to this program will be protected as ‘voluntarily submitted safety related data’” (FAA, 2004, p. 1). The phrasing in the advisory was the legal basis for protections, something which would later cause problems: liability issues for airlines, as judges ordered to release the QAR (Quick Access Recorder) data during court cases, a topic discussed in more depth later in this paper.

As described within 14 CFR part 13 section 13.401, FOQA data is to be anonymized. The data is to “be stripped of information that could identify the submitting airline prior to leaving the airline premises and, regardless of submission venue” (FAA, 2004, p. 1). The onus is placed on the airline to ensure that data is “stripped” of identifying data before it is received by the government, an action that absolves the government from the burden of responsibility of removing identifying characteristics As highlighted in Advisor Circular 120-82, the data is “only” used in aggregative capacities and is voluntarily submitted (FAA, 2004, p. 1). FOQA is a voluntary safety program that the FAA and airlines use as a “proactive” tool, resulting in catching safety "trends" and issues before they become a mistake or disaster. Charlie Precourt, former Air Force pilot and space shuttle pilot, speaks in an Avidyne Webinar about FOQA. Precourt notes, "they aggregate the data into a big database and they look for trends" then these trends are used to improve safety (2020). Being able to improve safety is a fundamental aspect of maintaining a safe and healthy aviation system. What's more, FOQA is the first program in the United States that is able to algorithmically analyze the data of multiple airlines at the same time to identify, for example, similarities, trends, and issues. The ability to analyze multiple data sets comes from the FAA being a government entity, rather than an individual airline who has access to only its own data.

The volunteer nature of the FOQA program means that airlines choose to participate; thus, participation is voluntary from the perspective of the government. Realistically, the same may not be true from the perspective of the pilot, as he or she does not volunteer to participate. They are forced by their employer. Alas, employment with an airline is the individual's will, so by choosing to gain employment with a carrier on the FOQA program, that pilot elects to be part of the data aggregation process. Nonetheless, the voluntary reporting of flight data could serve as a source of mistrust for pilots who may feel that it jeopardizes their job unjustly. Pilots who gain employment now, after FOQA has been in place, and it is known which airlines have it and which don't, may have a different perspective because they aren't being forced into it by their airline after their hire date.

The airlines are to supply the data with a particular data marking stating, "WARNING: This FOQA information is protected from disclosure under 49 U.S.C. 40123 and part 193. It may be released only with the written permission of the Federal Aviation Administration Associate Administrator for Regulation and Certification" (FAA, 2004, p. 1). With the aforementioned authorization statement, the airline enters into an agreement, based off the data marking, that once the data is provided to the FAA, the data is only to be released via writing, in the form of a "permission" from the Associate Administrator for Regulation and Certification. This extra action is to ensure the security and anonymity of the airlines who opt into this safety program. Unfortunately, there have been breeches of the anonymity. This is confusing when you consider that the data is to be scrubbed of identifying information before falling into the hands of the FAA. Nonetheless, there have been instances where information of a particular flight was identified and released in the event of a mishap, such as ASAP discovery on Flight 955 in Cali State, Colombia in 1997 in *Jaffee v. Redmond*, a case where recordings were released as part of common law "privilege" by a Federal District Court in M ami (Ali onti, 1998, p. 46). Alimonti writes,

> "The privilege, however, is not absolute but is a qualified privilege, which can be overcome if a plaintiff meets the burden of showing 'the importance of the inquiry for which the privileged information is sought; the relevance of that infor- mation to its inquiry; and the difficulty of obtaining the desired information through alternative means'" (1998, p. 47).

The finding that the anonymity of aggregated data was to be overturned, in court, did not speak well to the trust intrinsic, in providing anonymous data to the government. Instead, it was as if the database could be weaponized against the very airlines who opted in to provide anonymous data for the purposes of improved safety.

The United States District Court of Kentucky, Central Division, upheld a similar finding in 2008 against Comair by Southwest Airlines, Inc. In the upheld opinion, Judge Forrester notes that, "Comair admitted that 'Congress did not create a statutory privilege specifically for ASAP or other voluntary safety reports'" (2008). Unfortunately, the lack of legislative protection meant that airline "unique" data from QARs aggregated into databases was not protected from disclosure. Judge Forrester goes on to describe the scenario of legal action in the case, "Comair's brief brings to mind cymbals banging together very loudly, foretelling the destruction of the ASAP program and unsafe skies for the public if ASAP reports are not withheld from litigants on the basis of confidentiality" (2008). The cymbals were not enough, however, to prevent discovery of the data recorder recording information sent to the FAA for the purposes of anonymous aggregation, and they were released. The judge used a similar logic basis as Cali, arguing that need superseded protections.

Ultimately, the pleas of the airlines to protect the flight recorder data were heard by congress who enacted, Public Law 111-216, the AIRLINE SAFETY AND FEDERAL AVIATION ADMINISTRATION EXTENSION ACT OF 2010 into law on June 1, 2010. Section 214 is entitled, SEC. 214. ASAP AND FOQA IMPLEMENTATION PLAN, which speaks to plans to improve the program, such as accessibility for smaller fleet airlines and how carriers and inspectors can better utilize the data (111th Congress, 2010, p. 2366). These changes were to improve quality and quick data implementation of the ASAP and FOQA programs onto carriers. Section 213, VOLUNTARY SAFETY PROGRAMS, likely formed the regulatory basis for the FAA to work with carriers on better protecting the program, as it held the FAA accountable to feedback from the airlines. It required the FAA to submit a report to the Committee on Transportation and Infrastructure information on, "if an air carrier is using one or more of the voluntary safety programs, an explanation of the benefits and challenges of using each such program" (111th Congress, 2010, p. 2365). The changes achieved in this act enabled protections for the airlines to utilize voluntary safety programs with less fear of retribution. The program continues to this day, with 57 voluntary participants (FAA, 2021) and fewer supreme court case rulings against airlines who volunteer to share aggregated, anonymized safety data.

References

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Precourt, C. (2020). Using FOQA flight data intelligence to improve pilot performance and encourage flight safety. *Avidyne Webinar*. https://www.avidyne.com/avidyne-launches-foqa-initiative-business-aviation/

SLO 3: Apply knowledge from the aviation field of study to address problems in broader contexts.

Module 10 - Canvas Discussion Board Assignment: Provide an example of how employees adapt to working conditions as discussed in the Safety II literature.

Points Possible: 10

Due Date: 13 December 2021

Notification thru: Schedule, Module Lesson Plan, Discussion, Presentation, Email, Announcement

Submission: attached as Word or PDF documents to assignment link

Guidance and resources: Module Lesson Plan, Lecture, Directed Reading of the textbook, Optional Reading of short article, Instructions/Steps to success.

Student Submission: [redacted]

The White Paper From Safety I to Safety II discusses "some new practices to look for what goes right, focus on frequent events, remain sensitive to the possibility of failure, to be thorough as well as efficient, and to view an investment in safety as an investment in productivity" (Eurocontrol, 2013, p.3). This highlights some of the overarching principles that employees should look for when transitioning to a Safety II mindset. A specific example from the literature is when the Prague Airport increased significantly in size several proactive Safety II-inspired measures were taken, such as new traffic control measures, a new runway to reduce incursions, and new hydrant fuel distributions systems. All of these measures led to continued growth in traffic with a better safety track record than previous years (Kurzweil & Rehor, 2018).

Graduate Course Performance Indicator Rubric

Assess Student Learning Outcomes

Course: ASCI 5230 Professional Ethics and Standards Course Instructor: _Janice McCall____

Semester Taught:____Fall 2021______________Number of Students in Course:_____2___

Student Learning Outcome Assessed	Assessment Results: (Indicate what % of class achieved a minimum score of 80%)	Benchmark achieved? (Benchmark: 80% of students will score a minimum of 80% = "B")
SLO 3: Graduates will demonstrate competence in understanding and implementing ethical principles, regulations, and policies related to aviation/aerospace industrial practices.	100%	Yes
SLO 5: Evidence of scholarly and/or professional integrity in the aviation field of study.	100%	Yes

Course Assessment (Intended Use of Results)
The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

**Attach description of assignment used for assessment and samples of student work.*

SLO 3: Graduates will demonstrate competence in understanding and implementing ethical principles, regulations, and policies related to aviation/aerospace industrial practices.

Module 6 - Canvas Journal Assignment: Create a Diversity Statement for your aviation organization using the guidance provided in "Writing a Diversity and Inclusion Statement: How to Get It Right" (Heaslip, 2021).

Points Possible: 50

Due Date: 14 November 2021

Notification thru: Schedule, Module Lesson Plan, Discussion, Presentation, Email, Announcement

Submission: Online text reply to journal assignment link

Guidance and resources: Module Lesson Plan, Lecture, Directed Reading of the textbook, Optional Reading of short article, Instructions/Steps to success

Student Submission: Aaron Wilson

Wilson Air Center, Inc.

Mission, Vision, & Values

The mission of Wilson Air Center is provide excellent and genuine customer-focused service across every business segment every day. From our first point of contact with our primary customers on the flight line to each encounter with our various vendors, we strive to anticipate needs and to meet those needs with focused attention. You see, our vision here at Wilson Air Center is to be the premier customer service business. We want to be known for our service. We want to set the standard. To help achieve this level of service each team member is expected to be familiar with and apply the five values of Wilson Air Center:

1. Trust – We want to create an atmosphere of vulnerable trust. We want each team member to have the ability to articulate their ideas. We want to innovate.
2. Passion – We do not want our team members to merely follow their passion, we want each team member to bring their passion to work each day.
3. Enjoyment – We want each team member to enjoy their work. We believe there is no "bad job." All jobs offer opportunities for great satisfaction.
4. Integrity – We want to be honest, open, and ethical.
5. Awareness – We want members of each business segment to be constantly looking for and anticipating the needs of our customers and fellow team members.

Diversity and Inclusion Statement

Wilson Air Center recognizes the value and beauty of diversity. The leadership team at Wilson Air Center is committed to finding and growing individual team members that will deliver excellent service to our customers, community, and other stakeholders. We welcome and embrace the individual, which in a team brings diverse personalities, skills, and knowledge. We welcome the beauty that comes from happy people.

Wilson Air Center recognizes the importance of inclusion. The leadership team at Wilson Air Center is committed to developing a culture of people that genuinely desire the best for one another. Inclusion should be genuine and free from pretense. This internal commitment to inclusion should be so recognizable by those we come in contact with, that they express their appreciation of our welcoming atmosphere.

SLO 5: Evidence of scholarly and/or professional integrity in the aviation field of study.

Module 2 - Canvas Writing Assignment:

CASE STUDY
The case study in-brief, worth 100 points, may be completed through any of the following methods (due 28 SEP 2021):

- Individual 2–4-page paper (not including references) – follow the short paper guidance
- Group paper 4-6 pages (not including references) – follow the short paper guidance
- Individual recorded presentation (Zoom recording 5-10 minutes)
- Group recorded presentation (Zoom recording 8-20 minutes)

Group size is 2-4 students.
How to approach this case study in-brief:
This ethics case study in-brief, is a detailed exploration of one person, group/organization, or event in aviation. It is intended for students to examine the ethical dilemma and actions within the case and how they may apply in future settings. Many of the skills used in analyzing these ethics case studies become tools for responding to real world aviation problems later.
Case suggestions or choose your own ethical issue in aviation:…

Points Possible: 100

Due Date: 28 September 2021

Notification thru: Schedule, Module Lesson Plan, Discussion, Presentation, Email, Announcement

Submission: Attached to the assignment link as Word or PdF document

Guidance and resources: Module Lesson Plan, Lecture, Directed Reading of the textbook, Optional Reading of short article, Instructions/Steps to success, sample papers, weblinks for SLU Graduate writing center and Purdue OWL APA,

Student Submission: Michael Chertude

Note: *There may be slight formatting differences as this document was converted from PDF.*

Michael Chertude
ASCI 5230
28 September 2021

Karlene Petitt v. Delta Air Lines: Whistleblower Retaliation

Karlene Petitt has had an interesting career both professionally and academically. Being a professional female airline pilot for most of her life, she has witnessed many events which eventually persuaded her to pursue her PhD. After observing the cultural differences between the Delta Airlines and Northwest Airlines merger in 2008, she decided to pursue her PhD completing her dissertation on these experiences and the resulting aviation safety culture at Delta Airlines. She was able to utilize both her professional and academic expertise to effectively analyze Delta's Safety Management System (SMS), a recently implemented program for all airlines mandated by the Federal Aviation Administration (FAA). Unfortunately, shortly after presenting the safety concern paper to the company (which she was not paid or told to do), Delta Airlines had Petitt undergo Section 15 mental health evaluation where she was stripped of her flying duties. Delta Airlines tarnished Petitt's reputation by questioning her mental health because she was questioning their safety practices and culture, in direct violation of the Aviation Investment and Reform Act for the 21st Century (AIR 21) that provides whistleblower protection.

What Happened?

The safety report which Petitt presented to Delta executives were safety concerns surrounding "inadequate flight simulator training, deviation from line check evaluation procedures, pilot fatigue, and inadequate training and falsification of training records" (National Law Review, 2021). While some could argue that Karlene Petitt was 'aggressive' in the manner she pursued the safety concerns she believed were present, Delta Airlines responded in one of the worst possible ways. They did this by "formally questioning [her] mental fitness [which] stigmatizes that pilot in the eyes of the close-knit aviation community" (National Law Review, 2021). During the official court ruling later on, Judge Morris would conclude that Petitt's submission of the safety complaint was a contributing factor in Delta's decision to refer her for a mental health evaluation (National Law Review, 2021).

The timing of that mental health evaluation was one of the major sticking points in this case. Delta Airlines argued that a Section 15 mental health evaluation had been ordered after a large amount of time elapsed from the initial submission of the safety report. However, shortly after the safety report was submitted, there is documentation proving Delta Airlines leadership immediately questioned whether a Section 15 mental health evaluation should be given to Petitt. In fact, it was a mere six days after the safety report was submitted, that Captain Graham responded with an email to other leadership members that a Section 15 mental health evaluation may be required. It is also noted that Captain Graham "harbored little if any tolerance for criticism of the organization he ran, especially criticism from a line pilot like" Petitt (Petitt v. Delta, 2020, p. 71). Clearly, Delta's argument holds little weight since there are email chains documenting and requesting a Section 15 evaluation immediately after the safety report submission.

During the Section 15 mental health evaluation, Delta Airlines retained the services of Dr. Altman, who would go on to diagnose Karlene with bipolar disorder, even though he never reached "out to [her] Aviation Medical Examiner (AME), spouse, or others that regularly interacted with her. In fact, Dr. Altman failed to even reference the letters of support he received from friends of Complainant" (Petitt v. Delta, 2020, p. 56). This diagnosis did not rely on any facts or interviews and appears to have been decided on before the Section 15 was filed, which a Judge would later determine was Delta Airline's goal all along. Along with these facts, there are also possible sexist motives behind Dr. Altman's diagnosis as he was later is identified as having questionable motives and possible sexist beliefs. He would go on record as stating “that [Karlene] and her husband at one point had three children under three while attended night school earning a 3.7 GPA, and she worked at her husband’s business. Dr. Altman then said “I don’t know any woman who could do that. I don’t know any woman with three under three that isn’t exhausted, let alone going to school”” (Petitt v. Delta, 2020, p. 56). It is important at this point to point out that Delta female pilots only constituted 4.6% of the pilots.

Ethical Issues and Moral Principles

This case has many ethical issues, but the most significant one is the whistleblower retaliation which Delta Airlines exhibited. Not only was the retaliation against AIR 21, but it broke virtually all six moral principles: the principle of autonomy, non-maleficence, beneficence, justice, truth-telling, and promise-keeping. Arguably, the two moral principles which this case study violated the most are non-maleficence and truth-telling. When it comes to non-maleficence, the principle states “in all of your actions, avoid harming people” (Brown et al., 2017, p. 4). Although physical harm did not fall on Karlene Petitt, by falsely questioning her mental health, Delta Airlines stigmatized her amongst the pilot group as well as taking away her ability to earn income. The second moral principle violated was truth-telling. Truth telling instructs us to “maintain personal standards of conduct befitting a professional; respect yourself in all of your decisions so as to be worth of living a fulfilling professional life” (Brown et al., 2017, p. 4). During the lawsuit filed with the U.S. Department of Labor, fact finding by the court found multiple incidences of deceit and lying from Delta Airlines management when they recalled the accounts which lead to the Section 15 mental health evaluation. Because of this, the judge deemed multiple Delta Airlines employees in Karlene Petitt’s chain-of-command to be untrustworthy witnesses.

This case had multiple alternate solutions which could have occurred instead of the deceitful and damaging Section 15 which Delta Airline's leadership ordered. The most obvious alternate solution would have been to investigate the safety report Karlene Petitt submitted instead of instantly considering a Section 15 to essentially 'silence' her. Under no circumstances would questioning a pilot's mental health be appropriate unless there was actual concern for their mental health – with facts and clear evidence supporting the decision. Based on the evidence and the ruling from the judge for the U.S. Department of Labor, this was not the case. The judge cited intent from Delta Airlines and bad faith on their part for the Section 15, and emphasized it is never acceptable to retaliate when it comes to whistleblowers.

Conclusion

Delta Airline's handling of Karlene Petitt's safety report is troubling for multiple reasons. The managers directly above Karlene had an ethical obligation to not only her, but also to the thousands of passengers that board Delta aircraft every day. If there is ever a safety issue identified, it should be properly addressed. Instead, management decided to use Dr. Altman as "a tool by Captain Graham to effectuate a management objective" of keeping Karlene quiet (Petitt v. Delta, 2020, p. 97). By ordering a Section 15, they reneged on their ethical responsibility of non-maleficence and potentially put thousands of passengers at risk. This is the reason why the industry has AIR 21, and whistleblowers must be protected. Rather, the situation that unfolded at Delta Airlines was unethical, and should not be acceptable in the aviation industry or any culture.

References

Brown, J. P., Patankar, M. S., & Treadwell, M. D. (2017). *Safety Ethics*. Routledge.

Carlene Petitt v. Delta Air Lines, Inc (Petitt v. Delta). (https://www.ssmplaw.com/wp-content/uploads/2020/12/PETITT_v_DELTA_DECISION.pdf December 21, 2020).

National Law Review. (2021). DOL Judge Awards Airline Pilot $500,000 in Compensatory Damages in AIR21 Whistleblower Retaliation Case. (2021). *National Law Review*, *XI*(6). https://doi.org/https://www.natlawreview.com/article/dol-judge-awards-airline-pilot-500000-compensatory-damages-air21-whistleblower

Graduate Course Performance Indicator Rubric

Assess Student Learning Outcomes

Course: ASCI 5030 Aviation Security Management

Course Instructor: Terrence Kelly

Semester Taught: Spring 2022

Number of Students in Course: 4

Student Learning Outcome Assessed	Assessment Results: (Indicate what % of class achieved a minimum score of 80%)	Benchmark achieved? (Benchmark: 80% of students will score a minimum of 80% = "B")
SLO 3: Apply knowledge of the aviation field of study to address problems in broader contexts.	Precis LM 2 93.7% Precis LM 4 96.3% Precis LM 6 93.7 Precis LM 8 93.5%	Yes, all students achieved a Precis scores (average) above 80%
SLO 4: Articulate arguments or explanations to both a disciplinary or professional aviation audience and to a general audience, in both oral and written forms.	LM 1 DB 1 98% LM 1 DB 2 91.75% LM 1 DB 3 94.5% LM 1 DB 4 95.3% LM 1 DB 5 98.3% LM 1 DB 6 94.25% LM 1 DB 7 94% LM 1 DB 8 95.5%	Yes, all students achieved discussion board scores above 80%

Course Assessment (Intended Use of Results)
The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

SLO 3

I am satisfied with student performance with respect to the application of aviation knowledge in the field of aviation security. Each Precis required the student to identify an article from the literature and summarize the content of the major points surrounding the publication. I plan to continue this practice moving forward. In an effort for continuous improvement, I intend to require students to identify a contemporary resource rather than some of the older articles used by (some) students this semester.

SLO 4

I am satisfied with student performance with respect to interactions and discussions on the message boards. I provide questions for each learning module. Students are required to respond to each of my questions and respond (critique) to the commentary provided by their classmates. I intend to help students develop a skillset of articulating both the strengths and weaknesses associate with a particular academic argument. As a means of continuous improvement I intend to require student to posts both strength and weaknesses with the posts made by their classmates.

Precis 1 Examples

Summary of "The Perceived Costs and Benefits that Drive the Acceptability of Risk-Based Security Screenings at Airports"

Name Redacted

Department of Aviation, Saint Louis University

ASCI 5030: Aviation Security Management

Dr. Terry Kelly

February 11, 2022

Stotz, Bearth, Ghelfi and Siegrist (2022) undertook research funded by the Federal Office of Civil Aviation (FOCA) of Switzerland to investigate perceived costs and benefits that impact the acceptability of risk-based security screening. The researchers acknowledged that one way to create a more efficient security system is to implement more risk-based screening—where all passengers would be classified as low-risk and not screened as intensely or as higher-risk and would receive more intense screening—to replace current screening methods (similar to TSA Pre-Check in the US). The team undertook this study to better learn about the perceptions of risk-based screening (and by extension, acceptability) held by the general public and to determine what factors drive acceptability of security practices. In all, findings indicated that the main drivers of the general public's acceptance of security checks are people's perception of the process–like fairness, security perception, and travel comfort–rather than individual characteristics—like confidence in security personnel. The study also found that risk-based security practices are not perceived as an adequate alternative to current security practices. Risk-based security practices are currently perceived to be both a loss of security and unfair.

Previous studies that this research builds upon indicated that a security check is accepted if the individual passenger perceives that their benefits, such as not being selected for rigorous screening, outweigh the costs, like more time and effort required or lower levels of security. Previous research has also focused on the influence that people's individual characteristics (demographics) have on their perception of security checks. Stotz et al.'s work combines perceptions of cost/benefits of security checks along with people's individual characteristics, in the end allowing investigation on the different predictors of acceptability of risk-based security checks. The researchers utilized quantitative study of data from an online survey taken by a sample population of 477 viable candidates from the German-speaking part of Switzerland. The survey collected socio-demographic information and responses about general worldviews and attitudes toward security, then information about risk-based security screening and responses for opinions of that method in comparison with traditional screening checks. Data was analyzed using linear regression models through SPSS 26 to determine which factors predicted the acceptability of risk-based security checks. Independent variables considered were demographic characteristics, cultural worldviews, perception of terrorism at airports, fear of flying, confidence in security personnel. Secondary predictors were security perception, travel comfort, fear of being stigmatized, and fairness. Among the results, the researchers found "the higher the perception of security, fairness and travel comfort in relation to risk-based security checks were to be perceived as an acceptable alternative to traditional security checks" (Stotz, et al., 2022).

Overall, this research further advances conversations about improving aviation security. The major takeaway from lessons of this study (supported by previous similar studies) is that the general public's security perception is the priority driver in acceptance of security check method. So, if the aviation security industry was to move toward more risk-based screening methods, it would have to be demonstrated (not just communicated) that risk-based security practices make the system safer—a unique challenge, given that the formula for risk cannot be publicly shared. The sample of this study was also Swiss; for applicability in other countries, a similar study would likely need to be conducted with its specific population. In the US, where aviation security has been politicized, cultural differences may influence applicability of this study's results. Another limitation is that this study was simply based on hypotheticals through an online survey. Accurately judging the general public's perception might need to involve studying people passing through a risk-based security screening in practice through lived experience. In all, this study further supported that the general public does not perceive risk-based security measures to be as effective to the current screening process, and perception of security screening's effectiveness is subjective.

References

Stotz, T., Bearth, A., Ghelfi, S. M., & Siegrist, M. (2022). The perceived costs and benefits that drive the acceptability of risk-based security screenings at airports. *Journal of Air Transport Management*, *100*, 102183.

Precis LM 4 Example

Precis II: The TSA and Solitude

Name Redacted

Saint Louis University, Parks College of Engineering, Aviation and Technology

March 13, 2022

Wilkinson introduces the article, "Whispers in the closet: Reflections on TSA and solitude" with an introduction to the working definition of *privacy.* Privacy is defined as a legal entity, "a composite of legal definitions," and a "distinct civil right" (Wilkinson, 2020, p. 145). In doing so, Wilkinson establishes a functional definition which is contrasted to the concept of *solitude*. Solitude, itself, conjures images of remoteness or lonesomeness. Wilkinson define solitude within the boundaries of "vagueness," much like privacy, but it is an entity with a "theological and spiritual dimension" (2020, p. 145). The author notes that as society trends in a technological direction, that "both privacy and solitude may be at risk" (Wilkinson, 2020, p. 145). In introducing us to the thesis, an exploration of solitude, in the modern era, within the context of the TSA's governance of airport security, Wilkinson seeks to introduce us to a philosophical perspective on what airport security means for the individual at a personal and philosophical level. If privacy must be forsaken for security, how do we establish a boundary?

Wilkinson states, one place where the American understanding of privacy has evolved is through "ongoing negotiation has been highly visible is that of airport security checkpoints," noting the example that after 9/11, Americans chose to prioritize security over privacy (2020, p. 145). In presenting this pinnacle event that lead to the formation of the Transportation Safety Administration (TSA), Wilkinson shows us a turning point, philosophically and literally, in how American society changed to deprioritize privacy and solitude in exchange for a renewed sense of security. In this negotiation, Wilkinson offers an example, “Whether it be the now obsolete back scanners that produced near-naked images of passengers or the DHS (paid) Global Entry program, various new protocols have come into place over the years that renegotiate the line between security and privacy for airport travelers” (2020, p.145). In this example, Wilkinson demonstrates the exchange of privacy for security, giving the example of scanners that can produce naked images by “seeing through” clothing (and undergarments). The starkness of the language “near-naked images of passengers” and “new protocols” shows an un-human side of security, one where matter-of-factness, a naked body showing no weapons, and no option for privacy, are prioritized ahead of all else. “Individuals are reduced to numbers and mechanical procedures. Privacy is momentarily forfeited for the greater good” (Wilkinson, 2020, p. 146).

After going through an example where Wilkinson themselves was marked as “SSSS” on a boarding pass, indicating a security threat, requiring extra screening and physically invasive pat downs, Wilkinson ponders, “I thought to myself that there was nothing patriotic in happily accepting the government demonizing its cit- izens in the absence of due process” (2020, 147), which “begs” a good point: does the government forgo privacy, in exchange for (at least the image/appearance of) security at the expense of due process? Would are forefathers consider these “modern” procedures a constitutional violation of due process? Did the post 9/11 security-obsessed “culture” that came from it cause us to begin making legislative decisions and government “processes” out of line with our countries founding principles? Is it an anything to stop “the terrorists” mindset, but boy, we’ve started inflicting the pain on ourselves? Wilkinson speaks to these questions, “I would assume such an atti- tude to be the very opposite of patriotism, considering rule of law and due process are cherished national values,” further asking, “Had I been singled out for my non-European given name, my travel to Muslim majority countries, or my scholarship on Turkish Mus- lim thought?“ (2020, p. 147). In fact, in 2017 the American Civil Liberties Union published information, via a formal study, “criticizing the TSA Screening Passengers by Observation Techniques program as unscientific racial and religious profiling” (Wilkinson, 2020,

p. 147). By presenting a study, Wilkinson puts forth the argument, with evidence, that the TSA's security-first mindset and policies compromise privacy using unscientific methodologies and techniques. Perhaps the law has become a "license to harass," she posits; one fueled by pseudoscience and bias, as well as, TSA agents with "unquestionable authority" (Wilkinson, 2020, p. 147).

Ultimately, Wilkinson notes that from a legal perspective, privacy is not a guarantee of the US Bill of Rights (Wilkinson, 2020, p. 148). This explicit omission has resulted in a nebulous legal status for privacy. Are private citizens not in control of their own agency and privacy? Is it not reasonable to aggressively "search" individuals in an invasive way, such as naked body scanners and invasive pat downs at the will of a TSA agent acting at the behest of terrorism-hysteria-induced policy? The nebulously legal entity of privacy has to be shrouded beneath other statutes that serve as its lynch-pin, such as fourth amendment rights, protection against unreasonable "search" and seizure, first amendment freedoms of speech and religion, the fifth amendment forbidding the denial of life, liberty, and property without due process, the "right to be left alone," as defined by judge Thomas McIntyre Cooley in 1881, and a variety of legal court cases that speak to privacy protections (Wilkinson, 2020, p. 148-149). Basically, courts decide if the government has overstepped its bounds. Does this mean thou shall overstep and overstep until stopped by the judicial branch? This process sets a dangerous precedent, one where statesman and government actors are blind to the law and our governing documents, until a judge says otherwise. Who is it that decided airports are havens to the commodification of the elimination of privacy and why? Wilkinson, through philosophy, personal example, and the law leaves us to wonder.

Reference

Wilkinson, T. R. (2020). Whispers in the closet: Reflections on TSA and solitude. *Cross Currents, 70(2), 145-158.*

Discussion Board Examples

Question 1

Today, one of the threats to aviation security is due to the geopolitical tensions arising from Europe and the Middle East. Although conflicts seem to be never ending, this can really disrupt commercial flight operations. Geopolitical tensions also further play into the threat of danger areas and no fly zones. Sometimes altitude is no guarantee of safety and certain areas may need to be circumvented, costing time and fuel. An example of this is shown by the downing of flight MH17 over Ukraine in 2014, situations on the ground can have disastrous effects on airspace in excess of 30,000 feet (wtw, 2019 (Links to an external site.)).
These regions of danger areas, no fly zones, or conflict zone areas can be extremely limiting and commercially challenging to airlines. "ICAO Annex 17 requires States to share threat information with one another. This intelligence is designed to help States protect their national interest. This by advising their air carriers, through their National Civil Aviation Authority (NCAA) about any specific risks or evolving aviation threats (Butterfly Training, 2020 (Links to an external site.))." While conflicts are always persistent, as these tensions continue to grow, the threat of these conflict zones increases as well. It is interesting to further discuss how Annex 17 plays such a large role in our commercial operations especially when geopolitical tensions are rising like they are today.
Another interesting perspective is to look at how technology plays into geopolitical tensions. "Such geopolitical disturbances impacting airspace security look likely to continue, and with the spread of technology around the world and into space, the threats may become more unpredictable (wtw, 2019 (Links to an external site.))." Increasing technology can also increase power and weaponization. In a sense, geography starts to play less of a factor since technology is a way to shrink the world and can create even more threats to the US and our commercial operations that continue to be less predictable.

References

Campos, Philippe. “Aviation Security Threats Evolving for the Forthcoming Next Decade.” *Blog*, 9 July 2020, https://blog.butterfly-training.net/evolving-aviation-threats/ (Links to an external site.).
Haggman, Andreas. “Four Key Geopolitical Risks Likely to Affect Aviation Industry This Year.” *Willis Towers Watson*, 8 Mar. 2019, https://www.wtwco.com/en-US/Insights/2019/03/4-key-geopolitical-risks-likely-to-affect-aviation-industry-this-year (Links to an external site.).

Discussion Board Example 2

5. Discuss the implications of security on your research interest.

My main research interest, and what I'll be pursuing for my dissertation, surrounds early motherhood in the airlines. Specifically, the experience of mothers who are still nursing while returning to the flight deck from maternity leave. There is some crossover of that topic and aviation security, and what mostly comes to mind is about the hassles of passing through security checkpoints with breastmilk. The TSA does allow breastmilk to be passed through security, and airline pilots typically bypass that anyway with Known Crew Member screening, though.

Another interest of mine, and one that I will likely continue to explore in this course, is the psychological and emotional component of security and interacting with the security system. There are big feelings about aviation security in the US. There's a constant tension between individual privacy and national security; of those in the know, and those watching from outside the system. It's stressful to navigate, its failure could be hugely consequential, and it is often used as a political toy. Oh, and meanwhile, the threats to the system are constantly evolving and changing. Security and the issues it brings are far from a perfect science, and the learning and evolving process that is required by the system can clash with the human desire for stability and consistency.

Both of these topics are about human, lived experience, and the ways that the humans have to navigate the various realities of aviation in the present day. Aviation at large is a huge, complicated system that involves countless people working in tandem to work, and impacts each person differently. I find that fascinating.

Discussion Board Example 3

1. Discuss a few of the ethical considerations associated with secondary screening at TSA checkpoints.

Secondary screening is a standard procedure at the airport through which the TSA gets information for background checks of travelers and crew members. However, there is a privacy concern of airlines that provide passenger identification data to the federal government (Price & Forrest, 2016). Sharing personal data between agencies and institutions is a violation when the individuals have not consented to such transfers. Another ethical concern is that personal documents are used to label people as terrorist, drug smugglers or criminals even if they have not been proven guilty (The screening processes). The other ethical issue is body-search, removing shoes and luggage from the bags. Such a security check is uncomfortable and may denote a lack of respect since searches are done in public (Price & Forrest, 2016). However, most airports now have advanced technologies such as X-ray machines, which preserve the dignity of the passengers. In some cases, the screening procedure can be lengthy and time-consuming since there are at least three check-up points and people have to wait in line, which is time-consuming.

References

Price, J., & Forrest, J. (2016). *Practical aviation security: Predicting and preventing future threats*. Butterworth-Heinemann.

The screening processes. PowerPoint presentation

Discussion Board Example 3

1. Discuss a few of the ethical considerations associated with secondary screening at TSA checkpoints.

Secondary screening at TSA checkpoints is meant to provide risk-based security measures beyond the screening that all passengers receive. The nature of secondary screening not being conducted for every passenger does mean that questions of equity and fairness are raised, and the determinants for secondary screening are not always viewed as fair. By separating passengers in a checkpoint into low- and high- risk categories, the screening process introduces inequitable treatment among passengers.

One first ethical consideration is equity. It's noted that terrorism risk and aviation safety is inversely related to equity (as summarized by Nguyen, Rosoff & John, 2017). When all passengers are screened the same, perceived equity of that treatment is high, but perceived terrorism risk is also higher. When some passengers are treated differently (such as through the secondary screening process), the system may be perceived as safer by the general public, but is also viewed as less equitable. I think that that conclusion depends on whether you are the one selected for secondary screening or not, though.

Another ethical layer in security is the concept of privacy. Just as more equal treatment is perceived as the ethical "right" in the screening process, there is ethical ambiguity (read: differing opinions) on just how much privacy one person should give up to ensure a secure aviation system. The nature of secondary screening is a physical pat down of the passenger or check through their belongings, which at best can be uncomfortable/an inconvenience and at worst can be a violation of individual privacy rights. What each passenger considers to be the line from just to unjust varies between people, and even with procedures standardized through the TSA, I think people will always disagree on what is ethically correct.

Finally, there are opportunities for racial profiling or unjust selections in the secondary screening process. Secondary screening may be conducted at a TSO's discretion. Operating under the knowledge that TSOs are human and humans are biased and can select passengers for additional screening at their discretion therefore creates an opportunity for mistreatment. Behavioral profiling of passengers is utilized in the screening process, but there still exist opportunities for TSOs to allow bias to factor into their decision making. Research has shown that minorities and those with physical impairments and health conditions have been subjected to secondary screening at higher rates (Deno, et al., 2014). Dr. Kelly's example of being selected for a secondary screening, after questioning a TSO, comes to mind in this discussion. It seems to me that while there is a human decision-making process in the security system, it will always be subject to bias, and therefore, at risk of unethical activity.

References:

Nguyen, K. D., Rosoff, H., & John, R. S. (2017). Valuing equal protection in aviation security screening. Risk Analysis, 37(12), 2405-2419.

Deno, F., Diaz, C., Lliguicota, C., Norman, D., & González, R. O. (2014). TSA Screening Procedures: A Threat to Privacy. International Journal of Arts & Sciences, 7(3), 37.

Graduate Course Assessment Form

Assess Student Learning Outcomes

Course : ASCI 5470-01 Quantitative Data Analysis
Semester Taught: Spring 2022
Number of Students in Course: 5

Student Learning Outcome Assessed	Assessment Results: (Indicate what % of class achieved a minimum score of 80%)	Benchmark achieved? (Benchmark: 80% of students will score a minimum of 80% = "B")
2. Apply the major practices, theories or research methodologies in the aviation field of study.	SPSS 1 – 98%; SPSS 2 – 99%; SPSS 5 – 95%; MLR Design – 100%: AVG = 98%	Elements of Assessment (SPSS Assignments & MLR Design) yielded 98% and exceed the desired benchmark of 80%.
5. Evidence of scholarly and/or professional integrity in the aviation field of study.	SPSS 1 – 98%; SPSS 2 – 99%; SPSS 5 – 95%; MLR Design – 100%: AVG = 98%	Elements of Assessment (SPSS Assignments & MLR Design) yielded 98% and exceed the desired benchmark of 80%.

Course Assessment (Intended Use of Results)
The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

The assessment of student learning outcomes (2,5) – met the benchmark of 80%, where the students presented their scholarly and/or professional integrity on different aspects: statistical research design, using statistical software to analyze aviation/aerospace data, interpreting statistical data from their own research studies, exploring published research findings, interpreting published research findings, and presenting the research findings in APA format. Specific elements of assessment include Frequency Distribution (SPSS 1), Measures of Central Tendency (SPSS 2), Pearson Correlation (SPSS 5), and Linear Multiple Regression (LMR) design. Practice assignments were given during the course delivery: independent *t* test (SPSS 3), and Analysis of Variance (ANOVA – SPSS 4). For the upcoming semesters, the same elements of assessment "SPSS Assignments & MLR Design" will be used and more participation from the students will be encouraged.

**Attach description of assignment used for assessment and samples of student work.*

Investigating Correlation Between Distance Flown and Fare

Saint Louis University

Introduction

Flight distance is a major factor in how much it costs an airline to fly a given route. As flight distance increases air traffic control fees increase and more importantly fuel consumption increases. Ideally airlines would be able to increase fares as distance increases to counteract the increased costs. However competition often prevents airlines from pricing routes in a manner that directly reflects the cost to fly the routes. For example, fares in the 4th quarter of 2019 between New York and Los Angeles, a 2500 mile flight, averaged $382 (Keizer, 2022) while the much shorter route Charlotte to Myrtle Beach averaged $350 despite only being a 157 mile flight (Keizer, 2022b). Greater competition on the New York to Los Angeles route prevented airlines from raising prices to combat the increased fuel cost as the only charged $0.15/mile flown compared to $2.22/mile flown they charged on the Myrtle beach route.

This research examines the 100 most-flown routes (pre-COVID-19 pandemic) to determine the strength of the correlation between distance flown and average fare. This will give insight into airline pricing models and identify if competition is intense enough on the top 100 routes to remove flight distance as a major factor in influencing price.

Data Source

The Bureau of Transportation Statistics is an organization of the United States government that tracks various air travel statistics such as delays, lost baggage and fares. For fares they have recorded the average fare on the 1,000 most-popular routes (as determined by passenger count) in the contiguous United States every quarter since 1996. This information is stored in Table 1 – Top 1,000 Contiguous State City-Pair Markets of their *Consumer Airfare Report* (Keizer, 2022). For this research only data from the 4th quarter of 2019 was used as that was the last quarter of normal air traffic operations before the COVID-19 pandemic. Along with fares (*fare*) the table also contains the non-stop miles between the city-pair (*nsmiles*), number of daily passengers on the route (*passengers*) – though not necessarily non-stop, as well as other variables that weren't used in this research. *Passengers* was used to limit the data set to the top 100 most-popular routes which ranged from 2,330 to 23,884 passengers. The data set was limited to the top 100 routes to eliminate some of the effects of demand on airline pricing. The original data included routes that had only ~200 passengers a day (less than the equivalent of 2 737s a day) which is two orders of magnitude different from the most popular routes that had 10,000+ passengers a day (50+ 737s). By limiting the data to the 100 most-popular routes this research is comparing routes that all have sufficient demand for multiple airline to compete on that city pair which lessens the effects of the confounding demand variable (i.e. if there are 2300+ passengers a day that is enough demand for multiple airlines to offer multiple flights a day). *Nsmiles* served as the independent variable in this research and *fare* served as the dependent variable. Both *nsmiles* and *fares* are continuous quantitative variables as both can be any value not just specific values or integers (although *nsmiles* is rounded to whole integers and *fares* are rounded to the nearest cent). For visualization purposes an additional variable price-per-mile (*PPM*) was created by dividing each *fare* by its corresponding *nsmiles* value. This variable, while not valuable in determining if there is positive correlation between *nsmiles* and *fare*, allows the variability of the interaction between *nsmiles* and *fare* to be visualized in a frequency distribution as it enables the interaction to be more easily grouped (data is initially ungrouped).

Research Question

On airline routes between city-pairs in the contiguous United States with sufficient demand for there to be multiple airlines with multiple flights daily between the pair, does the average fare (USD) between the two cities positively correlate with the distance (miles) between the two cities?

Data Analysis

SPSS was used to perform the data analysis and the modified "Table 1 – Top 1,000 Contiguous State City-Pair Markets" data containing only the 100 most-popular flights was imported to the software. First, a table of descriptive statistics containing the count, mean, minimum, maximum and standard deviation for *nsmiles*, *fare* and *PPM* was created (Table 1). Second, histograms showing the distributions of *nsmiles*, *fare* and *PPM* were created (Figures 1-3). Third in order to visualization the correlation (or lack thereof) between *nsmiles* and *fare* a scatter plot was created and a trendline was added along with the R^2 value (Figure 4). Finally the Pearson Correlation between *nsmiles* and *fare* was calculated along with its significance level (Table 2).

Discussion

SPSS's descriptive statistics output for *nsmiles*, *fare* and *PPM* (Table 1) showed that no data was missing from the three variables. It also displayed that there was a wide range for each variable (2495 miles for *nsmiles,* \$265.75 for *fare* and \$0.797/mile for *PPM*).

Table 1. Descriptive statistics output from SPSS for *nsmiles*, *fare* and *PPM.*

	N	Minimum	Maximum	Mean	Std. Deviation
nsmiles	100	209	2704	1120.69	642.852
fare	100	121.55	387.30	208.0985	57.06799
PPM	100	.113914209115282	.911100478468899	.238261580931875	.145889279527713
Valid N (listwise)	100				

Figures 1-3 helped visualize the distribution of the data within those ranges and it was shown that each variable was positively skewed. The variability in *PPM* (Figure 1) is particularly interesting as that directly relates distance flown to fare. If the relationship between distance flown and fare was perfectly linear then the frequency graph would be a single bar (in that scenario the airlines would be charging a fixed amount per mile flown no matter the route). However, the graph shows that there is a wide range of *PPM*s which indicates that the fare per mile flown is dependent on the route. The positive skew does indicate that the overall data might be somewhat linear as the majority of values are concentrated around $0.20/mile with a few routes that the airlines are able to charge much more a mile (3 routes at $0.80/mile or greater). Figures 2 and 3 don't add much additional value beyond Figure 1 towards determining if there is a positive correlation between *nsmiles* and *fare* as they simply show the distribution of route distances and fare (they are both positively skewed as expected from Figure 1).

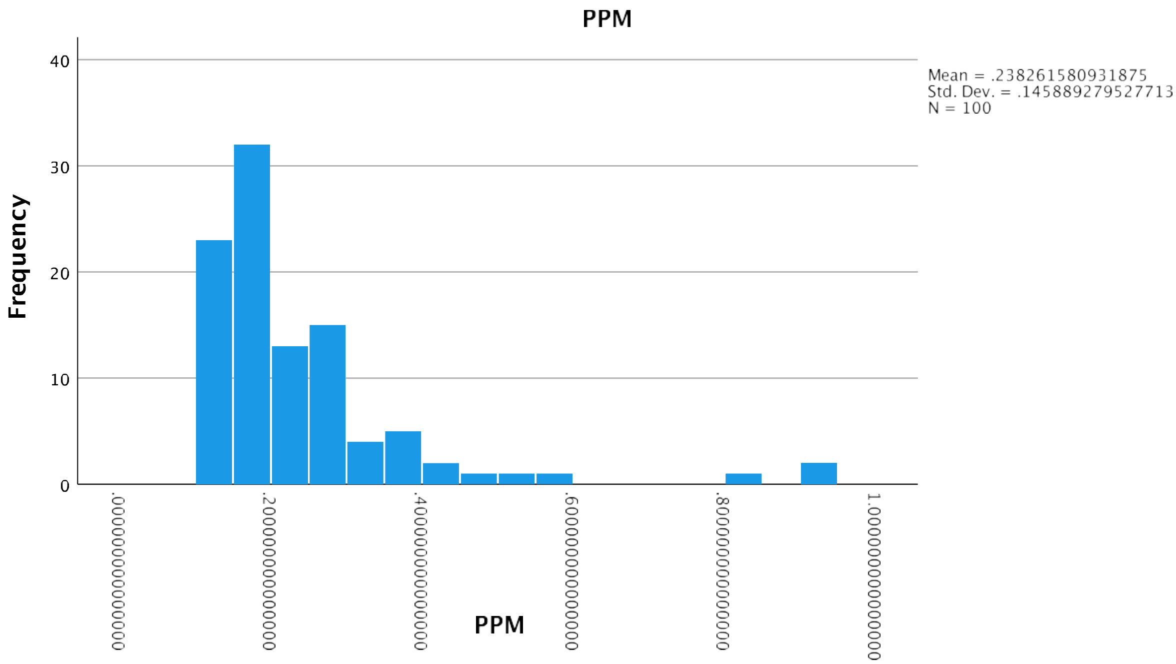

Figure 1. A histogram displaying the frequency of price-per-mile (*PPM*) which indicates how much an airline charged for each mile flown.

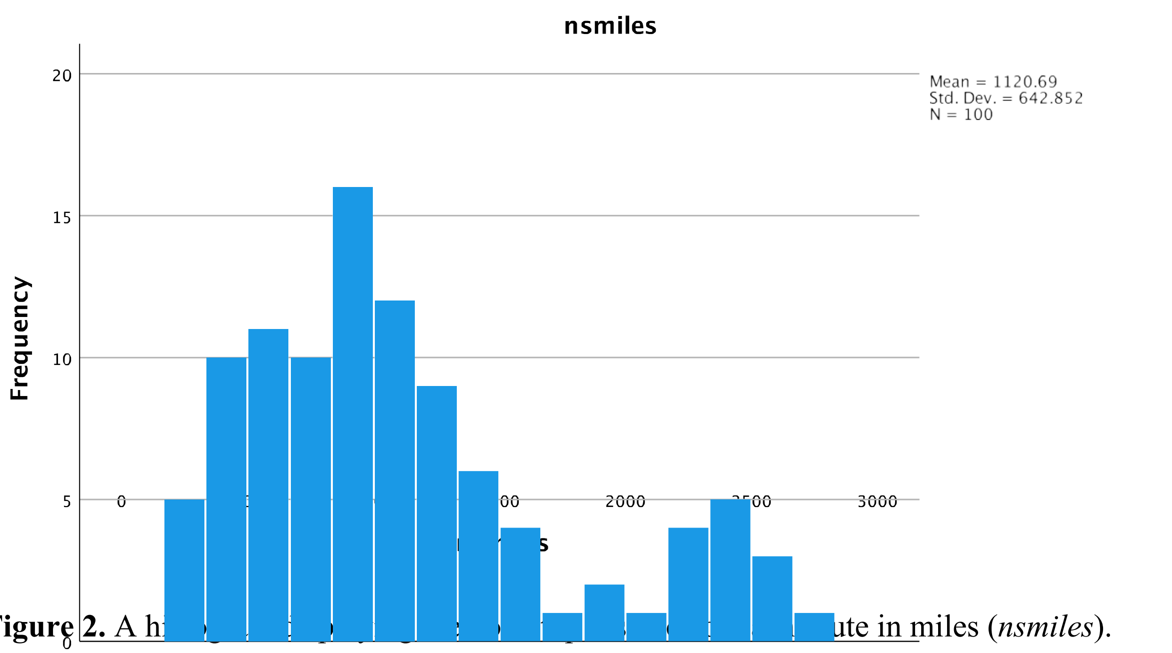

Figure 2. A hi … ute in miles (*nsmiles*).

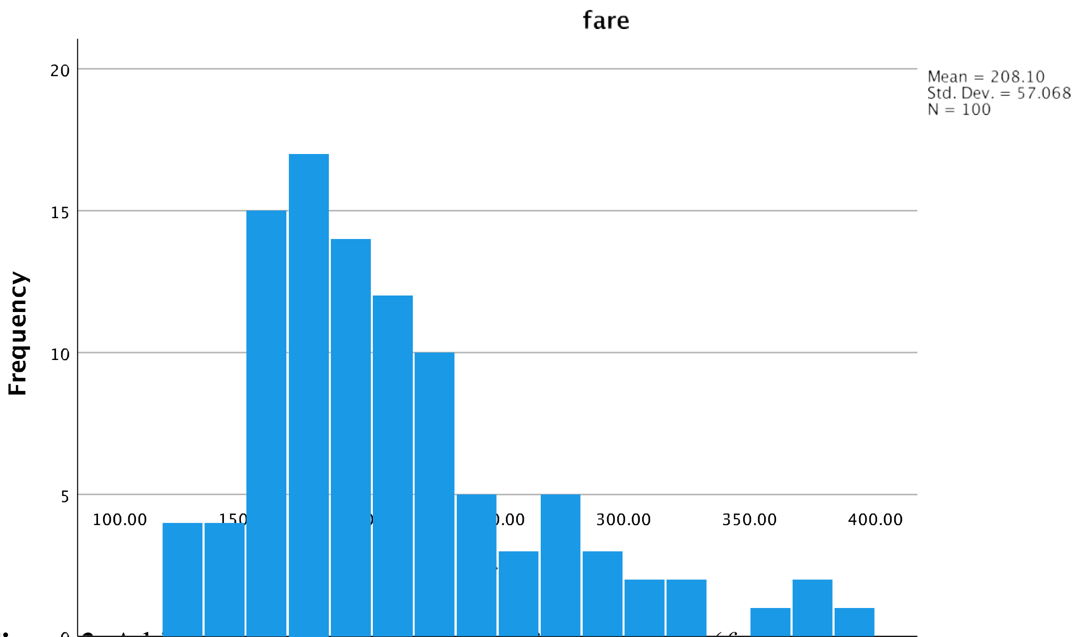

Figure 3. A histogram of the average fare for each route (*fare*).

The relationship between *nsmiles* and *fare* is visualized in Figure 4 and displays a significant positive correlation between the variables (R^2=0.756). Once it was determined that the variables were positively correlated, the Pearson Correlation test was used to determine if that correlation was statistically significant (Table 2). The Pearson Correlation test indicated that the strong positive correlation *nsmiles* and *fare* (r=.870) was statistically significant at the 1% level.

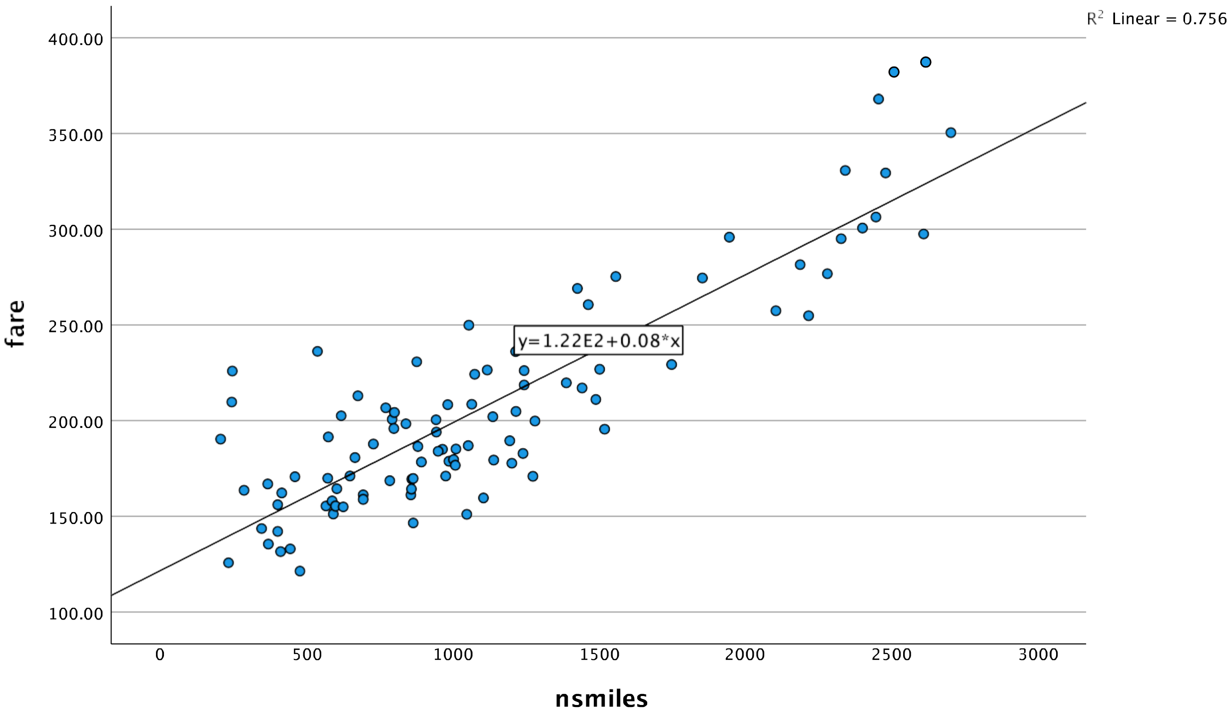

Figure 4. A scatter plot of *nsmiles* vs. *fare* displaying a strong positive correlation between the variables of R^2 = 0.756.

Table 2. SPSS tabular output of the Pearson Correlation test between *nsmiles* and *fare*. The correlation was found to be statistically significant at the 1% level.

		fare	nsmiles
fare	Pearson Correlation	1	.870**
	Sig. (2-tailed)		<.001
	N	100	100
nsmiles	Pearson Correlation	.870**	1
	Sig. (2-tailed)	<.001	
	N	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

Conclusion

The results indicate that there is a significant positive correlation between miles flown (*nsmiles*) and fare (*fare*) on the 100 most-popular airline routes in the contiguous United States. This may indicate that there is a minimum fare/mile flown that airlines are willing to price their flights at in competitive markets (likely around the breakeven point in profitably for those markets). Higher fares per mile flown in these competitive routes are likely not possible due the competition between airlines for market share which drives to prices to attract more customers to a given airline (and positively skews *PPM*). However, competition will not continuously drive prices lower than what is profitable for the airlines which is likely why the minimum *PPM* is around $0.114/mile flown which is around the cost per available seat mile (CASM) airlines in the United States which was $0.115 in 2017(Stalnaker, Alport, Buchanan, & Taylor, 2019). The few routes that are priced much higher than the mean *PPM* ($0.80+/mile vs. $0.283/mile) are likely on short popular routes that a single airline has high market share on (ex. a flight from a fortress hub to a mid-sized city). This research is currently limited by only using distance flown as a predictor of fare which can hide the more complex influences on airline revenue management as discussed above. Future research into the influence of distance flown on fare should account for airline market share, number of airlines serving route and differentiation between connecting traffic and non-stop flights.

References

Keizer, R. (2022, January 12). *Consumer Airfare Report: Table 1 - top 1,000 contiguous state city-pair markets: Department of Transportation - Data Portal*. Transportation.gov. Retrieved February 26, 2022, from https://data.transportation.gov/Aviation/Consumer-Airfare-Report-Table-1-Top-1-000-Contiguo/4f3n-jbg2

Keizer, R. (2022, January 12). *Consumer Airfare Report: Table 6 - contiguous state city-pair markets that average at least 10 passengers per day: Department of Transportation - Data Portal*. Transportation.gov. Retrieved February 26, 2022, from https://data.transportation.gov/Aviation/Consumer-Airfare-Report-Table-6-Contiguous-State-C/yj5y-b2ir

Stalnaker, T., Alport, G., Buchanan, A., & Taylor, A. (2019). (rep.). *Airline Economic Analysis*. Oliver Wyman. Retrieved February 25, 2022, from https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2019/apr/APRIL262019_Airline_Economic_Analysis_2018-2019vFweb.pdf.

SPSS Assignment 1

Evaluating the Impact of Augmented/Virtual Reality Training in Student Pilots Achieving Instrument Proficiency

Parks College, Saint Louis University

AVIA 5470, Quantitative Data Analysis

Professor Tamilselvan

SPSS assignment, due 25 February 2022

Evaluating the Impact of Augmented/Virtual Reality Training in Student Pilots Achieving Instrument Proficiency

The advances of Virtual Reality (VR) and Augmented Reality (AR) in aviation simulation have allowed training quality to increase and cost to decrease exponentially in recent years (Coleman & Thirtyacre, 2021). However, it is still a new and emerging technology, requiring many more studies and analysis to verify and document its potential impact in helping pilots train and increase in proficiency at a more rapid pace.

US Air Force Pilot Training is starting to incorporate AR and VR into their pilot training in an effort to decrease both cost and time required to train. In an effort to understand and evaluate the impact that AR/VR training can have in student pilot training, a snapshot is studied with the goal of ascertaining what level of benefit this additional training could have. In addition to flights, student pilots receive training in Aircraft Training Devices (ATD), or simulators. It is in these ATD that the AR/VR headsets are used to enhance training, not in the actual aircraft. The theory is that this additional training speeds up the process of learning in the aircraft. The entire pilot training syllabus is comprised of several different phases of training. In an effort to narrow down the scope of this research, only the instrument phase of training will be investigated. Proficiency is defined as achieving a grade of 4+ on a scale of 1-5, and a student pilot has 8 flights to achieve this proficiency before proceeding to the checkride (AETC, 2021).

Method of Analysis

Research Question

Did AR/VR training reduce the number of flights required for student pilots to achieve proficiency in the instrument phase of training, and if so, by how much?

Data Collection

As no websites have this information or data, and the author has not had a chance to procure the permission required by USAF to collect this data from pilot training bases, a dataset was constructed in Excel using the RANDBETWEEN function. Eight flights were listed, but the function was setup to randomly pull from flights number four through eight, as it was assumed based on the author's experience that no students achieved proficiency on the first three flights. The data was then transferred from Excel to SPSS in order to conduct analysis.

Data Analysis

The data used is grouped and discrete as it is round, defined numbers that represent the number of flight in which a minimum grade of four out of five was achieved. It is also very clearly quantitative in nature. Descriptive statistical analysis is performed using frequency analysis to compare the 12 students who had AR/VR training to the other 12 students from the class who did not receive that same training.

The data is presented using frequency analysis to display as histograms with a normal curve to help visualize the number of flights required for each student to achieve proficiency level of 4+. Table 1 is included to show the data used for this study. Two different figures are used to compare the half of the class that received the additional AR/VR training to the other half that did not receive the additional training.

Results

Summary and Conclusion

When reviewing the results of the students without AR/VR training, the mean was 6.42 flights when the students achieved the required proficiency. Upon comparing this to the mean of the students who did receive the additional training, which was 6.08, it is clear that the research shows a small advantage in favor of those with the additional training, 0.34 flights to be exact. A limitation to this study is the small sample size, which would limit the statistical significance of the study. However, a solid case can be made to further investigate the impact of AR/VR training in pilot training, as it can reduce flying hours required which can save significant costs, and increase pilot proficiency at a more rapid rate.

Tables

Table 1. List of students flight # on which proficiency achieved.

Student	AR/VR training	# of flight (achieved proficiency)
1	Y	5
2	Y	4
3	N	4
4	Y	5
5	N	6
6	Y	6
7	N	5
8	Y	8
9	N	8
10	N	7
11	Y	4
12	N	6
13	N	6
14	N	8
15	Y	7
16	Y	6
17	N	5
18	N	8
19	Y	8
20	N	5
21	Y	5
22	N	5
23	Y	8
24	N	6

Figures

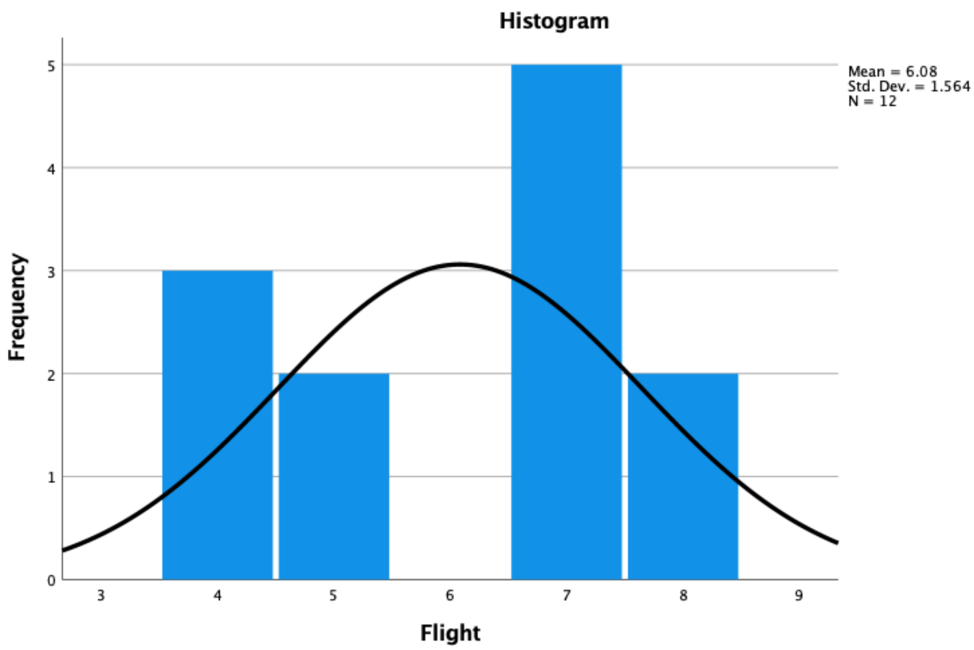

Figure 1. Total flights required to achieve proficiency for sample with AR/VR trainin

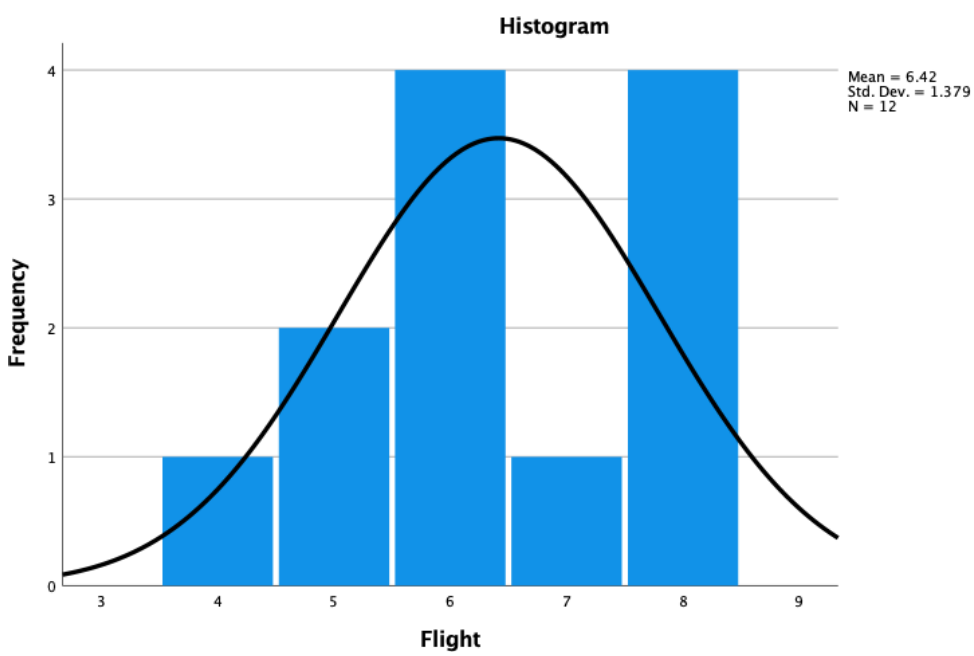

Figure 2. Total flights required to achieve proficiency for sample without AR/VR training

References

Air Education Training Command (AETC) (2021). AETC / ENJJPT Syllabus P-V4A-N (T-6) https://community.apan.org/cfs-file/__key/docpreview-s/00-00-19-62-50/AETC-ENJJPT-Syllabus-P_2D00_V4A_2D00_N-_2800_T_2D00_6_2900_-APR-21-POST-TQRB.pdf

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Influence of Origin Airport on Airfare at Large Airports

Saint Louis University

Introduction

There are several thousand commercial airports in the United States and prices to fly from these airports vary significantly. The fare for a route originating from a given airport is driven by both passenger demand and the supply of airlines' seats. Factors affecting each include the size of the city, season, number of competing airlines, and number of available non-stop destinations. For example JFK airport in New York City usually offers cheaper fares to many cities than a small airport like Peoria, Illinois. This is because JFK has many competing airlines (due to the large passenger demand) that fly to almost every city in the US with multiple frequencies which gives passengers more opportunities to influence price by flying a different airline or at an off-peak time. In contrast passengers flying from Peoria, Illinois have little ability to influence price as there are only a handful of flights a day to major cities on select airlines which means that passengers are largely forced to pay whatever the airline is charging for each route.

This research examines if large airports in the United States (defined for the purpose of this research as 1M+ originating passengers in 3Q 2021) have similar average fares as they all offer flights to many cities on many airlines at multiple frequencies a day. The aim is to provide insight into airlines' control over pricing at heavily competed large airports and passengers' willingness to pay high fares at those airports.

Data Source

The Bureau of Transportation Statistics is an organization of the United States government that tracks various air travel statistics such as delays, lost baggage and fares. Included in their database is the average fare paid by originating passengers at each airport grouped by airport size. For this research, only airports with over 1 million originating passengers in the 3rd quarter of 2021 were used. The 1 million passenger cutoff was selected to eliminate smaller airports with less gross passenger demand and fewer airlines competing for passengers. The 3rd quarter of 2021 was chosen as that was the latest available data and only a quarter was chosen as the Bureau doesn't publicly release the annual statistics for this data. Three data sets were collected from the Bureau to reflect all airports that met the 1 million originating passengers cutoff. They were: "Table 7.Fares at Airports with 2,000,000+ Originating Passengers 3rd Quarter 2021", "Table 8. Fares at Airports with 1.5M-1.99M Originating Passengers 3rd Quarter 2021", and "Table 9. Fares at Airports with 1M-1.49M Originating Passengers 3rd Quarter 2021" (United States Department of Transportation). A fourth data set was created by combining those three data sets to encompass all airports that served 1 million or more originating passengers in the 3rd quarter 2021. Each data set had the following columns: *Passenger Rank*, *Origin*, *3rd Quarter 2021 ($)*, and *3rd Quarter 2021 Originating Passengers*. *Passenger Rank* was dropped as it was simply a marker of the order of the airport by passenger count (i.e. second largest airport was "2") and summary statistics of it would not be illuminating. *Origin* was kept as it represented which airport the data was for. *3rd Quarter 2021 ($)* is the average fare in USD paid by originating passengers at the origin airport in the 3rd quarter of 2021, regardless of if the trip was one-way, round-trip, first class, or economy. *3rd Quarter 2021 Originating Passengers* is the number of passengers originating from the airport in the 3rd quarter of 2021 and was not included in the analysis aside from being used to identify which airports had over 1 million originating passengers.

Operational Definitions

For this research *Origin* serves as the independent variable as the research is aiming to observe the effect of the originating airport on average fare of an airport with over 1 million originating passengers in the 3rd quarter of 2021. The dependent variable is *3rd Quarter 2021 ($)* which is used to measure the effect of the originating airport on the average fare at airports with 1 million or more originating passengers in the 3rd quarter of 2021.

Research Question

For airports with over 1 million originating passengers in the 3rd quarter of 2021, did the originating airport have a significant effect on the average fare paid by those passengers?

Data Analysis

SPSS was used to perform the data analysis. Each of the four data sets were imported into SPSS for the purpose of gathering descriptive statistics. SPSS's Descriptive Statistics tool was used to calculate/record the N Statistic, Range Statistic, Minimum Statistic, Maximum Statistic, Sum Statistic, Mean Statistic, Standard Error, Standard Deviation Statistic, and Variance Statistic. Each table of statistics was saved and will be presented in the Discussion section of this report.

Discussion

The results for "Table 7.Fares at Airports with 2,000,000+ Originating Passengers 3rd Quarter 2021" were examined first as it was expected that those fares were the most likely to be similar across airports as the passenger demand and airline supply/competition were the highest at those airports (Table 1).

Table 1. Descriptive statistics output from SPSS for airports with over 2 million originating passengers in the 3rd quarter of 2021.

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
3rd Quarter 2021 ($)	5	61.4678310	269.196203	330.664034	1507.82261	301.564521	10.3189988	23.0739827	532.409
Valid N (listwise)	5								

In the 3rd quarter of 2021 there were five airports that had over 2 million originating passengers, they were (in order of passenger count): Los Angeles, Chicago, Denver, Atlanta and Seattle. The mean fare at these airports was $301.56 (SD=$23.07) and the average fare at a given airport ranged from $269.20 (Denver) to $330.66 (Los Angeles). The minimum and maximum indicate that the average fare at each of the five airports was within 2 standard deviations (+/- $46.14) of the mean.

Table 2. Descriptive statistics output from SPSS for airports with between 1.5 and 1.99 million originating passengers in the 3rd quarter of 2021.

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
3rd Quarter 2021 ($)	8	175.463917	223.659458	399.123375	2532.44046	316.555057	21.8474919	61.7940388	3818.503
Valid N (listwise)	8								

There were eight airports in the 3rd quarter of 2021 that had between 1.5 and 1.99 million originating passengers. They were (in order of passenger count): Newark, Dallas-Fort Worth, Boston, Orlando, Phoenix, New York JFK, San Francisco, and Las Vegas. The average fares at these airports for originating passengers ranged from $223 (Orlando) to $399 (San Francisco) with a mean of $316.56 (SD=$21.85). This range of $175.46 is almost triple the size of the range for those airports with over 2 million originating passengers ($175.46 vs. $61.47). The standard deviation was also much greater at $61.79 compared to $23.07. The increased range and variability of fares in airports with 1.5 to 1.99 million originating passengers reflects the increased variety of airports in this range. Instead of only business-oriented hub airports as seen in the 2 million passenger airports, this set of airports included tourist destinations such as

Orlando (average fare = $223) and Las Vegas (average fare = $233) which have a lot of low-cost carriers competing for customers and aiming to incentivize travelers with lower fares. The lower prices of leisure-oriented airports also reflects the greater price sensitivity of leisure travelers compared to business travelers. At the higher end of this range where business-oriented airports San Francisco (average fare = $399) and New York JFK (average fare = $362) that sell more premium seats and serve price-insensitive business traffic.

Table 3. Descriptive statistics output from SPSS for airports with between 1 and 1.49 million originating passengers in the 3rd quarter of 2021.

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
3rd Quarter 2021 ($)	12	123.920810	218.657833	342.578643	3604.82304	300.401920	10.6881256	37.0247532	1370.832
Valid N (listwise)	12								

Twelve airports served between 1 and 1.49 million originating passengers in the 3rd quarter of 2021. They were (in order of passenger size): Philadelphia, Houston Bush, Minneapolis/St. Paul, New York LaGuardia, San Diego, Detroit, Ft. Lauderdale, Baltimore, Tampa, Austin, Portland and Miami. The average fares for these airports ranged from $218.66 (Ft. Lauderdale) to $342.58 (Portland) with a mean of $300.40 (SD=$37.02). Again we see a leisure-oriented destination as the lowest average fare likely due to the same reasons listed for airports between 1.5 and 1.99 million originating passengers. Portland having the highest average fare is likely due to it being a less popular leisure destination that is not served by many competing airlines. Delta and Alaska Airlines dominate the market share at Portland and are able to use that market share dominance to keep air fares high. It is interesting that despite there being more airports in the 1-1.49 million passenger range than the 1.5-1.99 million passenger range that this range had a smaller range. This is likely due to none of these airports being one of the United States' largest business markets rather they include secondary business markets which often have lower premium seat demand and a greater number of leisure travelers. This appears to make these airports price below the very busy business-oriented airports which results in a smaller average fare range between the airports in the 1-1.49 million passenger range.

Table 4. Descriptive statistics output from SPSS for airports with greater than 1 million originating passengers in the 3rd quarter of 2021.

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
3rd Quarter 2021 ($)	25	180.465542	218.657833	399.123375	7645.08610	305.803444	8.68936616	43.4468308	1887.627
Valid N (listwise)	25								

Combining the data for all airports with over 1 million passengers results in a data set of 25 airports that have average fares ranging from $218.66 (Ft. Lauderdale) to $399.12 (San Francisco) for a range of $180 47. The mean fare across these airports was $305.80 (SD=$43.44). It is interesting to note that the range and the standard deviation was the smallest for the airports with over 2 million originating passengers which reflects the idea stated in the introduction that airports with the most passengers and airlines competing would have similar average fares due to the balancing of passenger demand with airline supply.

Conclusion

The results in Table 4 indicate that the originating airport is an influential factor in the average fare for airports with over 1 million originating passengers in the 3rd quarter of 2021. Average fares were more similar for the busiest 5 airports in the United States that had over 2 million originating passengers in the 3rd quarter of 2021, this could indicate that with enough passenger demand and competing airlines, fares at very large airports start to settle around a common average fare. At airports with 1 to 1.99 million passengers there was greater variance in mean fares as large leisure-oriented airports appeared in that range while some major business-oriented airports remained. Competition between low-cost airlines and greater elasticity in passenger demand at large leisure-oriented airports caused their fares to be significantly lower than fares at large business-oriented airports.

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United States Department of Transportation. (n.d.). *Table 8. fares at airports with 1.5m-1.99m originating passengers 3rd quarter 2021*. Bureau of Transportation Statistics. Retrieved March 21, 2022, from https://www.bts.gov/topics/airlines-and-airports/table-8-fares-airports-15m-199m-originating-passengers-3rd-quarter

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SPSS Assignment 2

Analyzing differences in student pilots who receive additional augmented reality training to those who do not receive that training

Parks College, Saint Louis University

AVIA 5470, Quantitative Data Analysis

Professor Tamilselvan

SPSS assignment 2, due 21 March 2022

Analyzing differences in student pilots who receive additional augmented reality training to those who do not receive that training

As technology advances, so do training environments, as they are both so intertwined. Augmented and Virtual Reality, especially in the aviation training environment, have the potential to increase speed of learning and proficiency for student pilots (Coleman & Thirtyacre, 2021). This capability is being implemented by the U.S. Air Force at Vance AFB in Joint Specialized Undergraduate Pilot Training 2.5. The simulators, called Aviation Training Devices (ATD), were configured to work with new Augmented Reality goggles in order to help students learn tasks hopefully at a quicker pace and higher proficiency than with just the ATD and aircraft that was previously used.

In an effort to understand and evaluate the impact that AR/VR training is having in USAF student pilot training, a snapshot is studied with the goal of ascertaining what level of benefit this additional training could have. The theory is that this additional training speeds up the process of learning in the aircraft. The entire pilot training syllabus is comprised of several different phases of training. In an effort to narrow down the scope of this research, only the instrument phase of training will be investigated, which consists of eight flights (AETC, 2021). Students all receive the same number of ATD training, half of them without AR/VR enhancement, and the other half with. Each student's grade is captured for every flight, and then the average is calculated to use that as the overall performance in the instrument block of training.

Method of Analysis

Research Question

How did students who received AR/VR training differ in proficiency from students who did not receive this additional training during the instrument phase in USAF pilot training? The answer to this question could show that this is a new, efficient way to train student pilots. However, as it is a small sample size, further investigation would be warranted to corroborate any potential findings in this study.

Data Collection

As the author has not had a chance to procure the permission required by USAF to collect this data from pilot training bases, a random dataset was constructed in Excel using the researcher's expertise from having been a pilot training instructor for five years. The grades for eight flights for 24 students were compared and averaged, and this average grade was used as the continuous, dependent variable in the testing. The data was then transferred from Excel to SPSS in order to conduct analysis.

Data Analysis

The data analyzed is on a small sample size, and there are many factors that play into how students perform in pilot training besides AR/VR training. Some examples of this are prior flying experience, age, motor skills, cognitive skills, etc. It is assumed that since it is a random sample in that these students just happened to be in this class this variability will be negligible.

Descriptive statistical analysis is performed to calculate the range, the sum, the mean, the standard deviation, and the variance of each of the subsets of 12 students. These two sections of the class are then compared to the other half in an attempt to ascertain if there are any differences in proficiency.

Tables 1 and 2 are included to show the data used for this study. Table 1 contains the grades on each of the eight flights for the 12 students who received AR/VR training and Table 2 has the grades for the eight flights for the 12 students who did not receive AR/VR training.

Data Interpretation

The range between the minimum and maximum statistic of flight grades average was identical in both sets of data, 1.75. This is both realistic and expected, as the grades could be between 1 and 5, with both a grade of 1 and 5 not being given very frequently. A grade of 1 is basically no proficiency at all, and a grade of 5 is equivalent of excellent, and no improvement required. A grade of 2 equals unsatisfactory, which is common in the first flight or two; a grade of 3 equals fair, and a grade of 4 is a good, and the minimum proficiency required to pass this phase of training.

When comparing the mean of both sets of data, the students who received AR/VR training performed slightly better than those that didn't. The mean was 3.34 with a standard deviation of .144 and variance of .207, compared to 3.23 with a standard deviation of .131 with a variance of .25. The standard deviation and variance indicate that there are normal and expected differences in the reported grades, as there should be progression throughout the phase of training.

Summary of Research Findings

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
grade	12	1.750	2.375	4.125	38.750	3.22917	.131312	.454877	.207
Valid N (listwise)	12								

Figure 1. Table of descriptive statistics of students who received AR/VR training

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Grade	12	1.750	2.500	4.250	40.125	3.34375	.144440	.500355	.250
Valid N (listwise)	12								

Figure 2. Table of descriptive statistics of students who did not receive AR/VR training

Conclusion

When reviewing the results of the students without AR/VR training, the mean was slightly below the mean of the students with AR/VR training. The data shows a small advantage in favor of those with the additional training, as their grades were slightly higher, albeit only 0.12 on a scale of 1-5. A limitation to this study is the small sample size, which would limit the statistical significance of the study. However, a solid case can be made to further investigate the impact of AR/VR training in pilot training, as it can increase pilot proficiency at a more rapid rate with the added training and ultimately provide costs savings.

Tables

Flight #	St1	St2	St3	St4	St5	St6	St7	St8	St9	St10	St11	St12
1	2	1	2	3	3	3	2	3	3	2	2	1
2	2	2	3	3	3	3	2	3	4	2	2	2
3	3	2	3	3	3	4	3	3	4	3	3	2
4	3	2	4	3	4	4	3	3	4	3	3	2
5	3	3	4	4	3	4	4	4	4	4	3	3
6	4	3	3	4	4	4	4	4	5	4	4	3
7	4	3	4	5	4	4	4	4	5	4	4	3
8	4	4	5	5	4	4	5	4	5	4	4	4
average	3.125	2.5	3.5	3.75	3.5	3.75	3.375	3.5	4.25	3.25	3.125	2.5

Table 1. List of grades for eight flights for students who received AR/VR training

Flight #	St13	St14	St15	St16	St17	St18	St19	St20	St21	St22	St23	St24
1	2	1	2	2	3	3	2	3	3	2	2	1
2	2	2	2	3	3	3	2	2	4	3	2	1
3	2	3	2	3	3	3	3	3	4	3	3	2
4	3	3	4	3	4	4	3	3	4	3	3	2
5	3	3	3	4	3	4	4	4	4	3	3	3
6	3	3	4	4	4	4	4	4	5	4	3	3
7	4	3	4	4	4	4	4	4	4	4	4	3
8	4	4	4	5	4	4	4	4	5	4	4	4
average	2.88	2.75	3.13	3.5	3.5	3.63	3.25	3.38	4.13	3.25	3	2.375

Table 2. List of grades for eight flights for students who did not receive AR/VR training

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A Review of the Southwest Effect

Saint Louis University

Introduction

In 1993, Randall Bennett and James Craun coined the term "�e Southwest Effect" to capture the idea that when Southwest Airlines entered a market their low fares caused the fares of the other carriers serving that market to drop in order to compete with Southwest (Bennett & Craun, 1993). Further research by Steven Morrison in 2001 estimated that the Southwest Effect was responsible for $9.5 billion dollars in lower fares at airlines competing with Southwest (Morrison, 2001). In recent years Southwest has raised their prices to be much closer to competitors while maintaining the perception that they are still a low-cost carrier (French & Geller, 2022). �is research examines fares on the 100 most-flown routes in the United States in the 4th quarter of 2019 (pre-COVID-19 pandemic) to investigate if there is continued evidence of the Southwest Effect. �is is done by limiting the 100 most-flown routes to markets that Southwest Airlines offers the lowest average fare and observing the correlation between their fares and the average fare across all airlines for those markets. A strong correlation between Southwest fares and the average fare for a given market would provide continued evidence of the Southwest Effect. However, if there is not a correlation between Southwest fares and the average fare then the Southwest Effect may be a thing of the past as the other airlines aren't allowing Southwest to influence their fares.

Data Source

�e Bureau of Transportation Statistics is an organization of the United States government that tracks various air travel statistics such as delays, lost baggage and fares. For fares they have recorded the average fare on the 1,000 most-popular routes (as determined by passenger count) in the contiguous United States every quarter since 1996. �is information is stored in Table 1 –

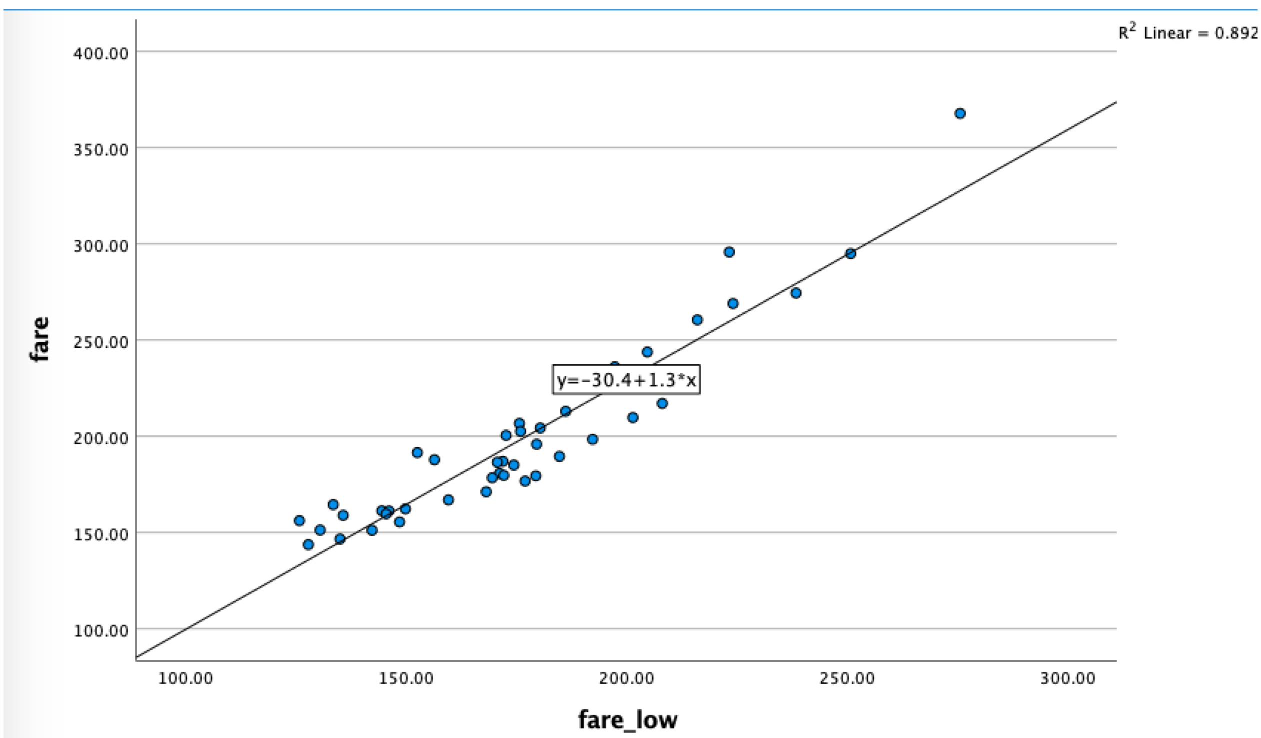
Top 1,000 Contiguous State City-Pair Markets of their *Consumer Airfare Report* (Keizer, 2022). For this research only data from the 4th quarter of 2019 was used as that was the last quarter of normal air traffic operations before the COVID-19 pandemic. Along with fares (*fare*) the table also contains the average fare on each route of the airline that offers the lowest average fare on that route (*fare_low)*, the airline offering the lowest average fare on a given route (*carrier_low)*, the market share of each route of the airline that offers the lowest average fare (*lf_ms*), number of daily passengers on the route (*passengers*)(not necessarily non-stop), and other variables that weren't used in this research. �e data set was limited to the top 100 routes (measured by *passengers*) to eliminate some of the effects of demand on airline pricing. �ese 100 routes had passenger counts ranging from 2,330 to 23,884 passengers. �e original data included routes that had only ~200 passengers a day (less than the equivalent of 2 737s a day) which is two orders of magnitude different from the most popular routes that had 10,000+ passengers a day (50+ 737s). By limiting the data to the 100 most-popular routes this research is comparing routes that all have sufficient demand for multiple airlines to compete on that city pair which lessens the effects of the confounding demand variable (i.e. if there are 2300+ passengers a day that is enough demand for multiple airlines to offer multiple flights a day). �ose 100 routes were then limited to the 45 routes where Southwest offered the lowest average fare (i.e. was *carrier_low*) to better test the Southwest Effect. (�e fact that Southwest offers the lowest fare on 45 of the 100 most popular routes in the United States does on its own lend credence to the Southwest Effect.) Southwest being *carrier_low* served as the independent variable in this research while *fare* and *fare_low* served as the dependent variables. *Carrier_low* is a categorical variables while both *fare* and *fare_low* are continuous quantitative variables as both can be any value not just specific values or integers (*fare and fare_low* are rounded to the nearest cent).

Verification of Statistical Assumptions

To use the Pearson Correlation for analysis, the data needs to meet four assumptions: random sampling, independence, linearity and normality. For this data set collected by the Bureau of Transportation we assume that the random sampling and independence assumptions have been satisfied. To test the linearity assumption the scatterplot observance method was used (Figure 1). Figure 1 demonstrates that there is a positive linear relationship (R^2=0.892) between the two dependent variables *fare* and *fare_low*, thus the linearity assumption is satisfied.

Figure 1

Scatterplot of Linear Relationship Between *Fare* and *Fare_low*



�e normality assumption was tested using the Shapiro-Wilk Test and the Q-Q Normal Test for both independent variables. Based on the Shaprio-Wilk Test *fare*_low was determined to be normally distributed as it had a p-value greater than 0.05. However, the p-value for *fare* was significant at the 5% level indicating that the data may not be normally distributed. �e Q-Q Normal Test was used to further investigate if the variables could be assumed normal for this study. Figures 2 and 3 display that the data points for *fare* and *fare_low* are both distributed close enough to the diagonal line to indicate that they meet the normality assumption for the purposes of this study.

Table 1

�e Results of the Shapiro-Wilk Test for Normality for *Fare* and *Fare_low*

	Shapiro-Wilk		
	Statistic	df	Sig.
fare	.876	45	<.001
fare_low	.957	45	.095

Figure 2

The Normal Q-Q Plot for Fare Demonstrating That It Meets the Normality Assumption

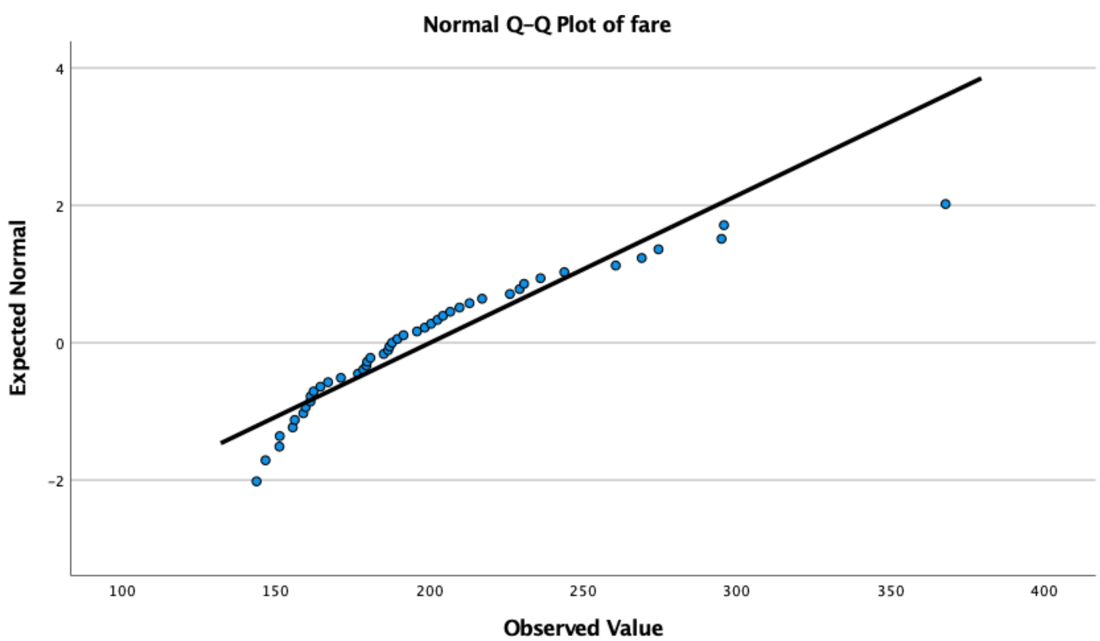
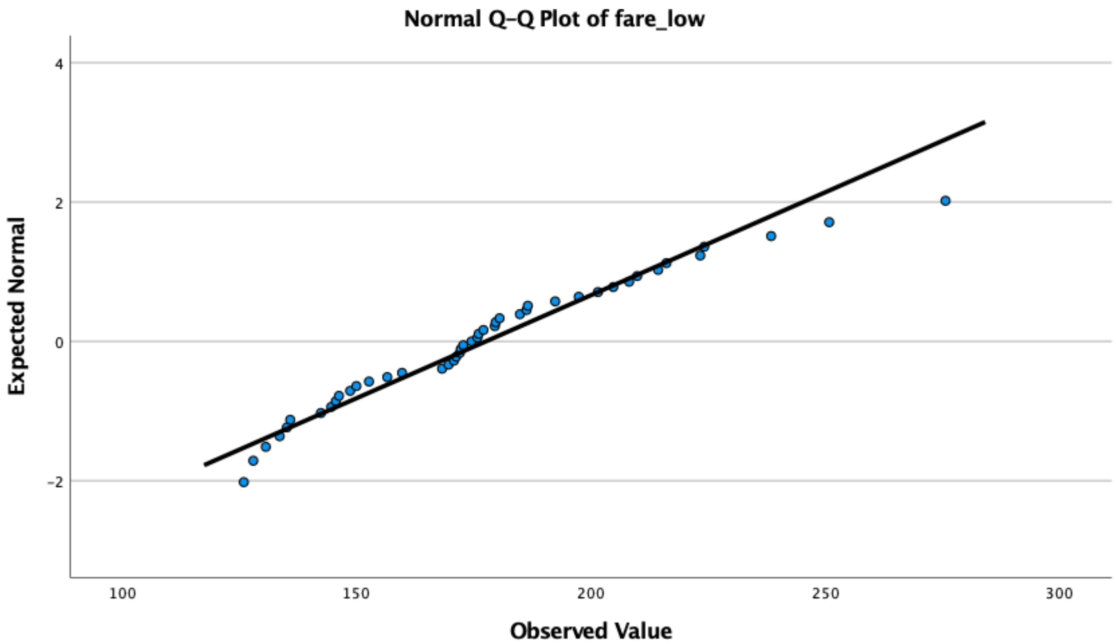


Figure 3

The Normal Q-Q Plot for Fare_low Demonstrating That It Meets the Normality Assumption



Research Question

On airline routes between city-pairs in the contiguous United States where Southwest Airlines is the airline that offers the lowest average fare on the route, is there a correlation between average fare and the average fare offered by Southwest on those routes?

Statistical Hypotheses

H_0: $\rho = 0$, �ere is not a significant relationship between the average low fare and the average fare on routes where Southwest is the airline with the lowest average fare.

H_1: $\rho \neq 0$, �ere is a significant relationship between the average low fare and the average fare on routes where Southwest is the airline with the lowest average fare.

Population

�e target population for this study is all flights operated on routes that were served by Southwest Airlines in 2019. Of that target population, data is accessible for flights operated in the fourth quarter of 2019 on the top 1000 city-pair routes in the United States (across all airlines). As described in the **Data Source** section the sample used for this study was the 45 routes of the 100 most-trafficked routes in the United States in the 4^{th} quarter of 2019 where Southwest offered the lowest average fare.

Data Analysis

SPSS was used to perform the data analysis and the modified "Table 1 – Top 1,000 Contiguous State City-Pair Markets" data containing only the 45 routes that Southwest was the lowest cost carrier (of the 100 most-popular routes) was imported to the software. First, SPSS was used to create a scatter plot of *fare_low* versus *fare* to determine if the linearity assumption required to use the Pearson Correlation was met (Figure 1). Second, the normality assumption for both *fare_low* and *fare* was investigated using SPSS's Shaprio-Wilk Test as well the Q-Q Normal plotting function to develop a Q-Q Normal plot for both variables (Figures 2 & 3). Finally, a two-tailed Pearson Correlation was calculated using SPSS. �is created a table of descriptive statistics containing the count, mean, and standard deviation for *fare* and *fare_low* (Table 2) as well as the Pearson Correlation table showing the correlation between *fare* and *fare_low* along with its significance level (Table 3).

Discussion

SPSS's descriptive statistics output for *fare* and *fare_low* (Table 2) showed that across the 45 routes that Southwest offered the lowest average fare, their fare (*fare_low*) was on average $22.71 cheaper than the overall average fare (*fare*) on a given route ($177.54 compared to $200.25). It is interesting to note that the standard deviation for *fare* was also higher than the standard deviation for *fare_low* (46.55 vs. 33.84) which could indicate that the relationship between *fare_low* and *fare* is route-dependent as airlines compete differently on price for different routes.

Table 2

Descriptive Statistics Output from SPSS for Fare and Fare_low

	Mean	Std. Deviation	N
fare	200.2467	46.55169	45
fare_low	177.5380	33.84125	45

�e Pearson Correlation output (Table 3) shows that there is a strong positive relationship between *fare_low* and *fare* that is statistically significant at the 1% significance level (r(45) = 0.944, p<0.001). �is indicates that 89.2% of variation in *fare* can be explained by variation in *fare_low* (R^2=0.892). �e positive direction of the correlation between *fare_low* and *fare* means that an increase in *fare_low* is correlated with an increase in *fare* (Figure 1). As the correlation between *fare_low* and *fare* is statistically significant at the 1% level the null hypothesis is rejected.

Table 3.

The Result of the Pearson Correlation Test Between Fare and Fare_low

Inter Correlation between Variables (N=45)

Variable	1	2
Fare	-	.944**
Fare_low	.944**	-

**p<0.01

1 – Fare; 2 – Fare_low

Conclusion

�e results indicate that there is a statistically significant positive correlation between the fare offered by the carrier that offers the lowest average fare (*fare_low*) and fare (*fare*) on the 45 routes that are both one of the 100 most-popular airline routes in the contiguous United States and have Southwest as the airline that offers the lowest fare on the route. �is result rejects the null hypothesis that there would not be a significant relationship between the average low fare and the average fare on routes where Southwest is the airline with the lowest average fare. A failure to reject the null hypothesis would have been evidence that the Southwest Effect is no longer relevant as other airlines displayed indifference to Southwest's fares with their own fares.

While the results of this paper demonstrate that the Southwest Effect may be alive and well in 2019, further research needs to be performed to determine if the Southwest Effect's effect is unique to Southwest or if a similar correlation would be found for any airline that offers the lowest average fare on a subset of routes. A comparison of the correlation between *fare_low* and *fare* across all of the 100 most-trafficked routes versus the correlation on just routes that

Southwest offers the lowest average fare (the research of this paper) would help determine if it matters that Southwest is the airline that offers the lowest fare on a route.

References

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Appendix A

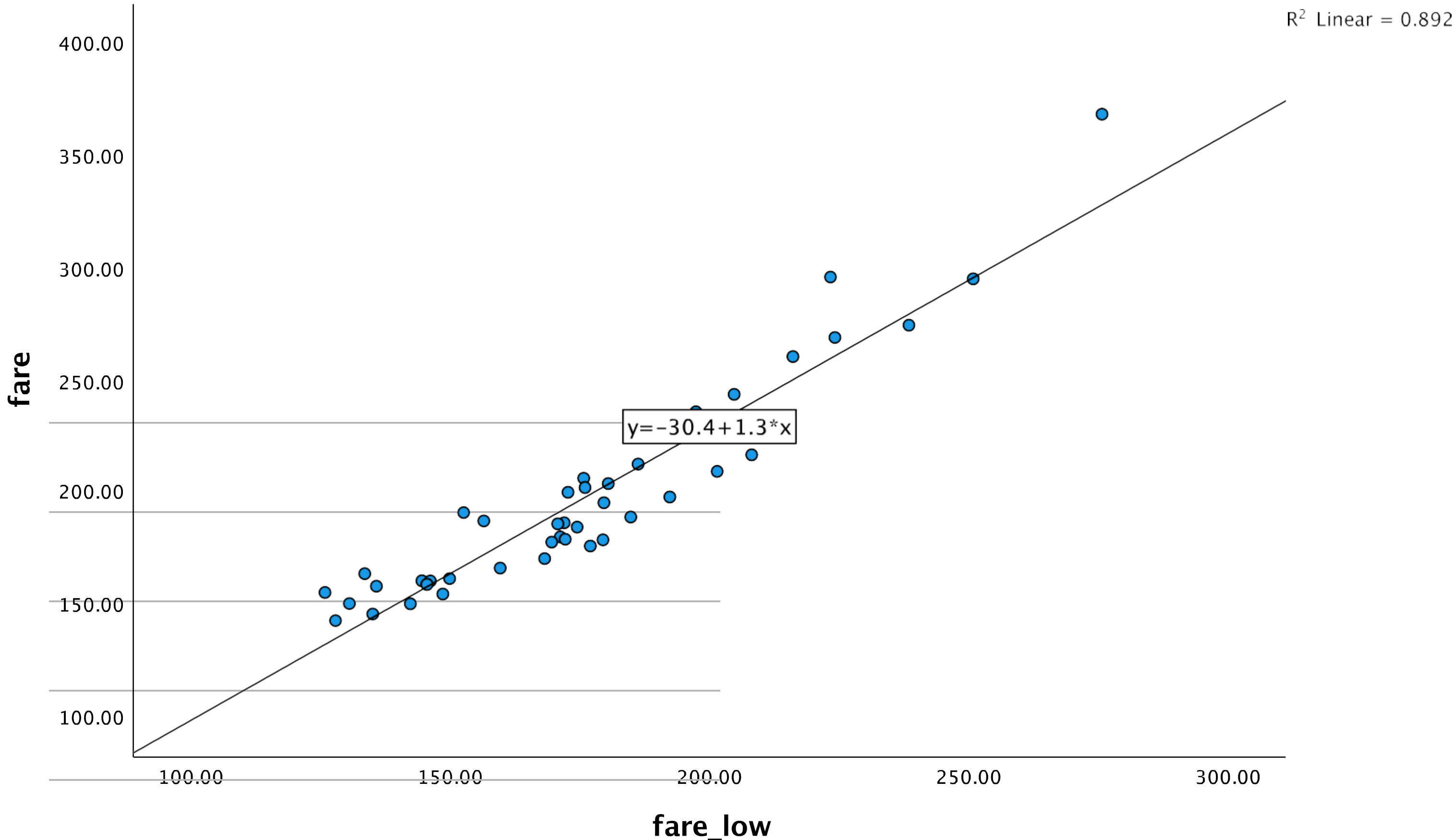
Raw SPSS Output

Graph

Notes

Output Created		15-MAY-2022 02:14:19
Comments		
Input	Data	/Users/Peter/Documents/WN_Top100_Routes.sav
	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	45
Syntax		GRAPH /SCATTERPLOT(BIVAR)=fare_low WITH fare /MISSING=LISTWISE.
Resources	Processor Time	00:00:00.35
	Elapsed Time	00:00:00.00

[DataSet2] /Users/Peter/Documents/WN_Top100_Routes.sav



Notes

Output Created		15-MAY-2022 02:17:25
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	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	45
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=fare fare_low

		/PLOT BOXPLOT STEMLEAF /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
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	Elapsed Time	00:00:00.00

Explore

Notes

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Comments		
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	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	45
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=fare fare_low /PLOT BOXPLOT STEMLEAF NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE

		/NOTOTAL.
Resources	Processor Time	00:00:00.71
	Elapsed Time	00:00:01.00

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
fare	45	100.0%	0	0.0%	45	100.0%
fare_low	45	100.0%	0	0.0%	45	100.0%

Descriptives

			Statistic	Std. Error
fare	Mean		200.2467	6.93952
	95% Confidence Interval for Mean	Lower Bound	186.2610	
		Upper Bound	214.2323	
	5% Trimmed Mean		196.1866	
	Median		187.8500	
	Variance		2167.060	
	Std. Deviation		46.55169	
	Minimum		143.75	
	Maximum		367.82	
	Range		224.07	
	Interquartile Range		58.21	
	Skewness		1.501	.354
	Kurtosis		2.777	.695
fare_low	Mean		177.5380	5.04476
	95% Confidence Interval for Mean	Lower Bound	167.3710	
		Upper Bound	187.7050	
	5% Trimmed Mean		175.7192	
	Median		174.5000	
	Variance		1145.230	
	Std. Deviation		33.84125	
	Minimum		125.91	
	Maximum		275.64	
	Range		149.73	
	Interquartile Range		50.16	
	Skewness		.712	.354
	Kurtosis		.482	.695

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
fare	.133	45	.043	.876	45	<.001

fare_low	.110	45	.200*	.957	45	.095

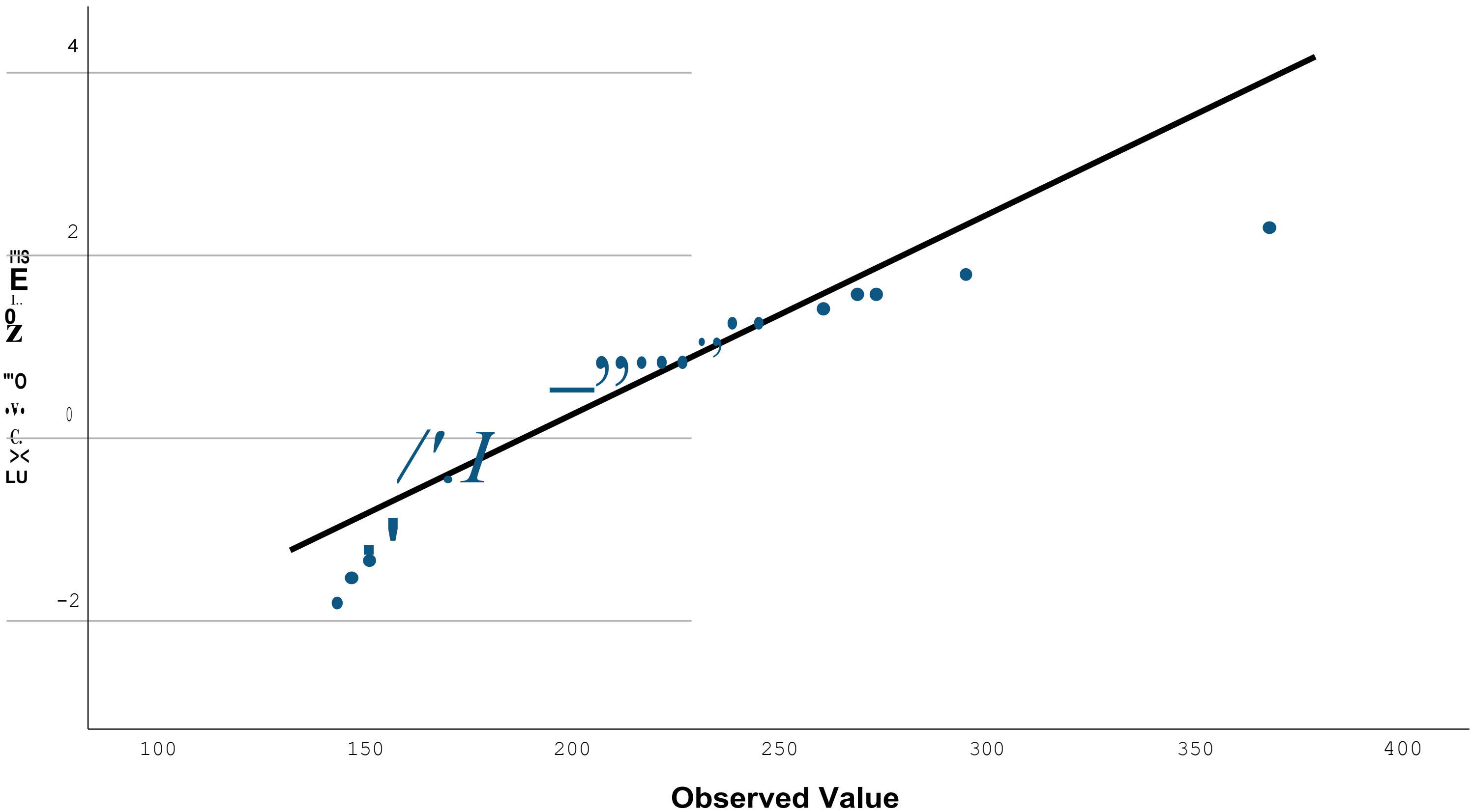
*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

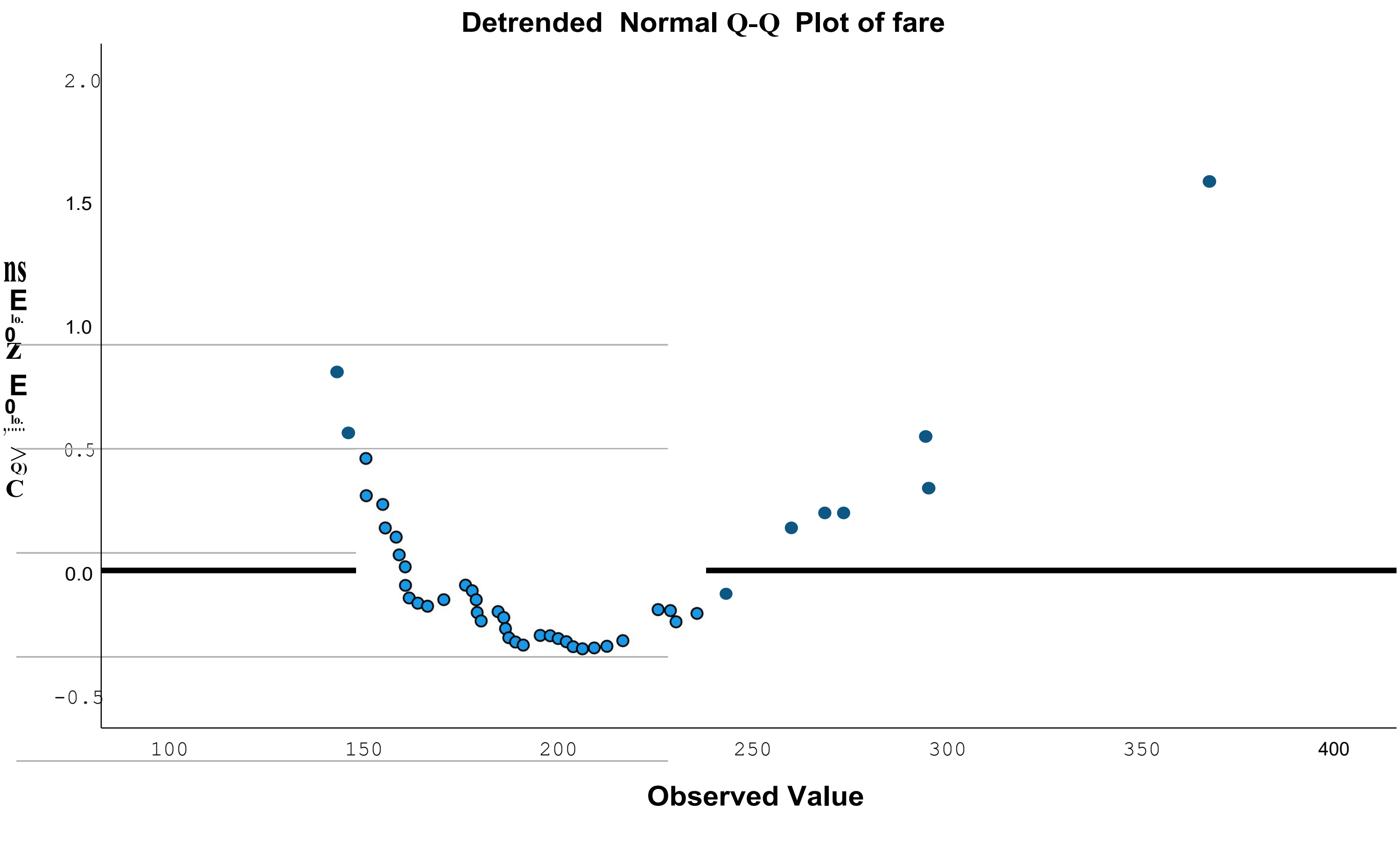
fare

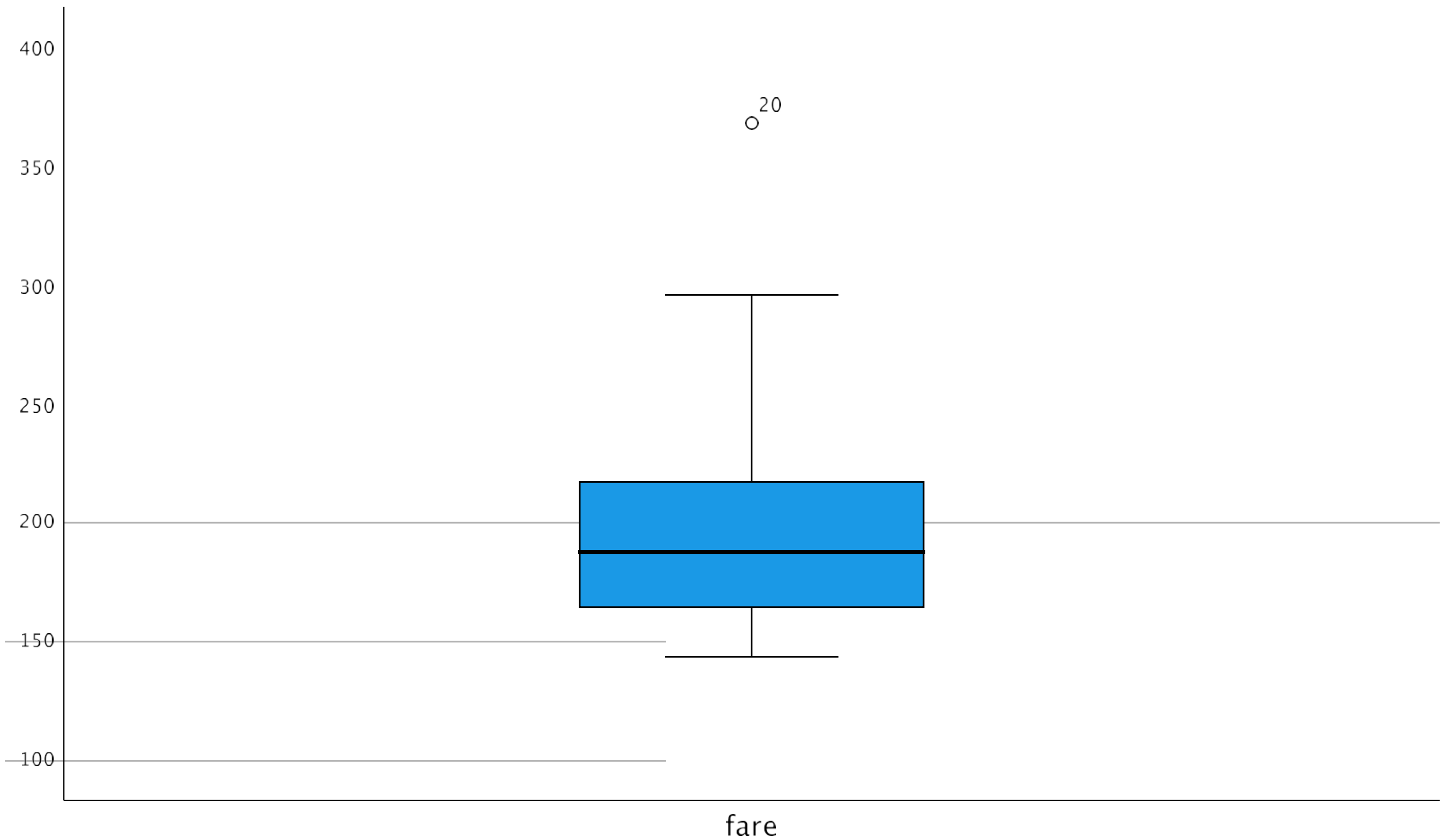
fare Stem-and-Leaf Plot

```
 Frequency    Stem &  Leaf

     8.00        1 .  44555555
    10.00        1 .  6666677777
     9.00        1 .  888888999
     7.00        2 .  0000011
     4.00        2 .  2233
     1.00        2 .  4
     3.00        2 .  667
     2.00        2 .  99
     1.00 Extremes    (>=368)

 Stem width:  100.00
 Each leaf:       1 case(s)
```

Normal Q-Q Plot of fare




Detrended Normal Q-Q Plot of fare
2.0
1.5
1.0
0.5
0.0
-0.5
100
150
200
250
300
350
400
Observed Value

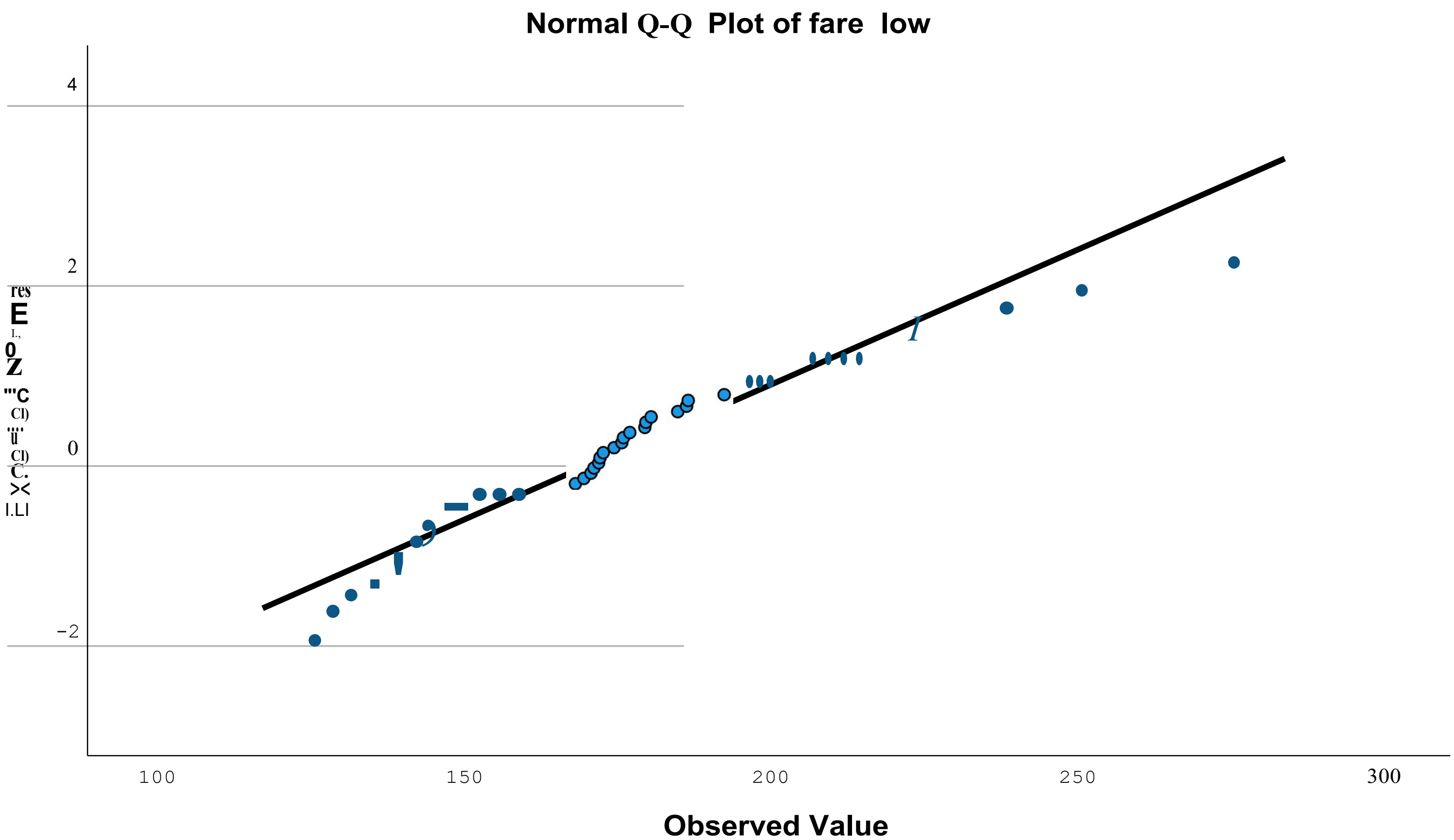


fare_low

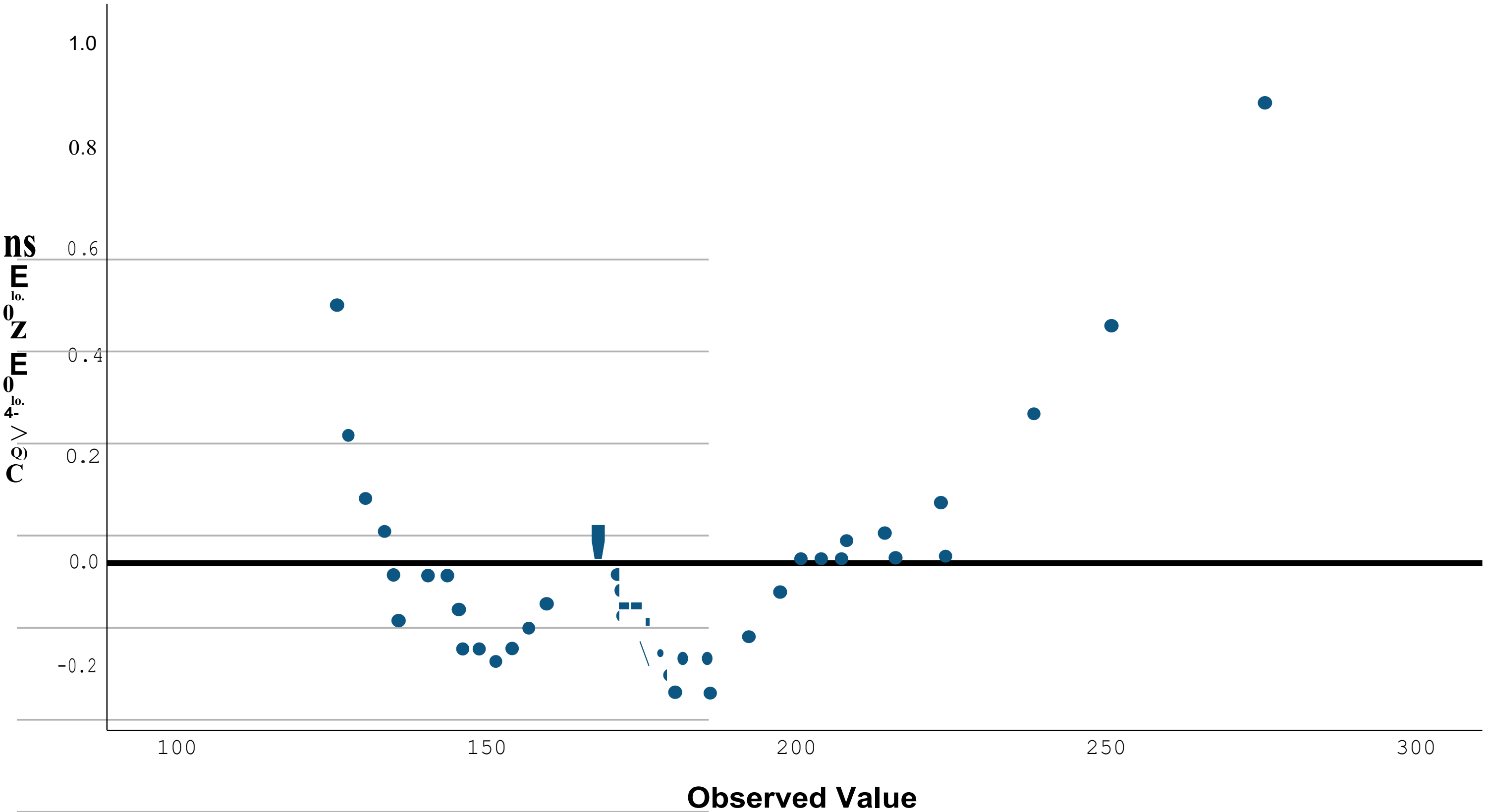
fare_low Stem-and-Leaf Plot

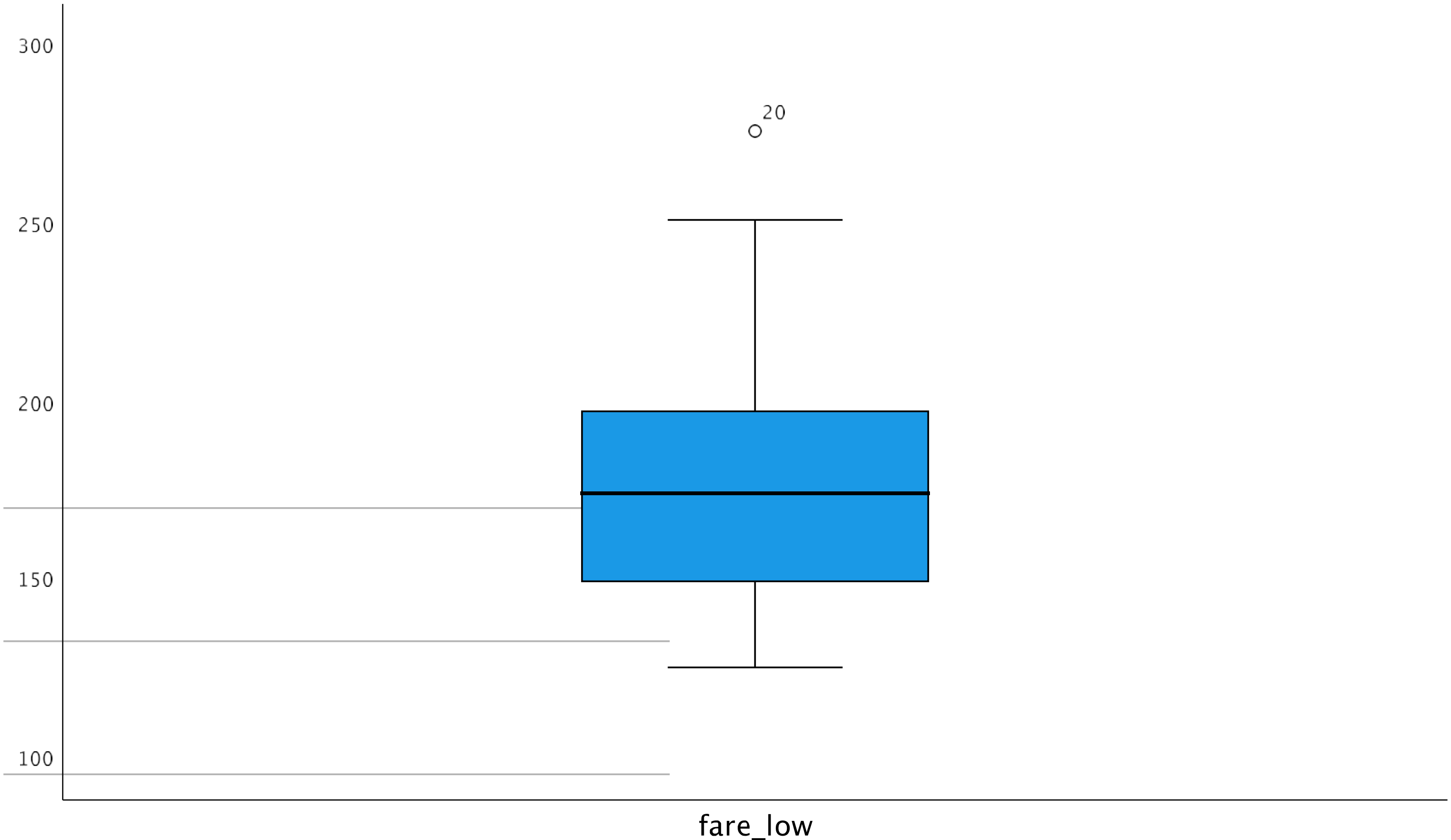
Frequency	Stem &	Leaf
6.00	1 .	223333
9.00	1 .	444444555
13.00	1 .	6677777777777
6.00	1 .	888899
6.00	2 .	000011
3.00	2 .	223
1.00	2 .	5
1.00 Extremes		(>=276)

Stem width: 100.00
Each leaf: 1 case(s)


Normal Q-Q Plot of fare low
4
2
0
−2
100
150
200
250
300
Observed Value

Detrended Normal Q-Q Plot of fare low





Correlations

Notes

Output Created		15-MAY-2022 02:23:10
Comments		
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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.

Syntax		CORRELATIONS /VARIABLES=fare fare_low /PRINT=TWOTAIL NOSIG FULL /STATISTICS DESCRIPTIVES /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.00

Descriptive Statistics

	Mean	Std. Deviation	N
fare	200.2467	46.55169	45
fare_low	177.5380	33.84125	45

Correlations

		fare	fare_low
fare	Pearson Correlation	1	.944**
	Sig. (2-tailed)		<.001
	N	45	45
fare_low	Pearson Correlation	.944**	1
	Sig. (2-tailed)	<.001	
	N	45	45

**. Correlation is significant at the 0.01 level (2-tailed).

SPSS Assignment 5

Pearson Correlation Assessment for Impact of

Augmented/Virtual Reality Training in Student Pilots

Parks College, Saint Louis University

AVIA 5470, Quantitative Data Analysis

Professor Tamilselvan

SPSS assignment, due 18 May 2022

Pearson Correlation assessment for Impact of Augmented/Virtual Reality Training in Student Pilots

As Virtual Reality (VR) and Augmented Reality (AR) technology advances, especially in aviation training devices, both training quality and realism increase, which in turn can lead to a cost decrease and faster paced learning (Coleman & Thirtyacre, 2021). However, it is still a developing technology; many more studies and analysis are required to verify and document its potential impact in helping pilots train and increase proficiency at a more rapid pace.

US Air Force Pilot Training is starting to incorporate AR and VR into their pilot training in an effort to decrease both cost and time required to train. In an effort to understand and evaluate the impact that AR/VR training can have in student pilot training, one phase of instrument training of one class of 20 students is analyzed with the goal of determining what impact this additional training could have. In addition to flights, student pilots receive training in Aircraft Training Devices (ATD), or simulators. It is in these ATDs that the AR/VR headsets are used to enhance training, not in the actual aircraft. The theory is that this additional training speeds up the process of learning in the aircraft.

The entire pilot training syllabus is comprised of several different phases of training. In an effort to narrow down the scope of this research, only the instrument phase of training will be investigated. Proficiency is defined as achieving a grade of 4+ on a scale of 1-5, and a student pilot has 8 flights to achieve this proficiency before proceeding to the checkride (AETC, 2021).

Data Source

The data used in this study was simulated using information from the author's experience and time spent in USAF Pilot Training as an instructor to represent a realistic sampling of actual pilot training students' performance. The data represents normal and average student progression with some variations to represent over and under achievers. The two dependent variables analyzed will be grade point average in the eight-flight phase of instrument training for a class of 20 students, and the flight number at which each student achieved minimum instrument proficiency, as previously defined.

Verification of Statistical Assumptions

This analysis will be making several assumptions as it tests for a linear correlation between these two variables. One assumption is homoscedasticity, where is it assumed that the data variance is equally scattered on the scatter plot. The next assumption is linearity, where it is assumed that the best way to represent a correlation of data is using a straight line. The third assumption is normality, where it is assumed that the data points are normally distributed (Privitera, 2018). Additionally, the data can be considered random sampling as a random pilot training class was selected, which is comprised of students of different ages, gender, and skill level. When looking at the resultant scatter plot below from SPSS, the linearity of the data can be observed and a determination can be made that a relationship exists between the two dependent variables.

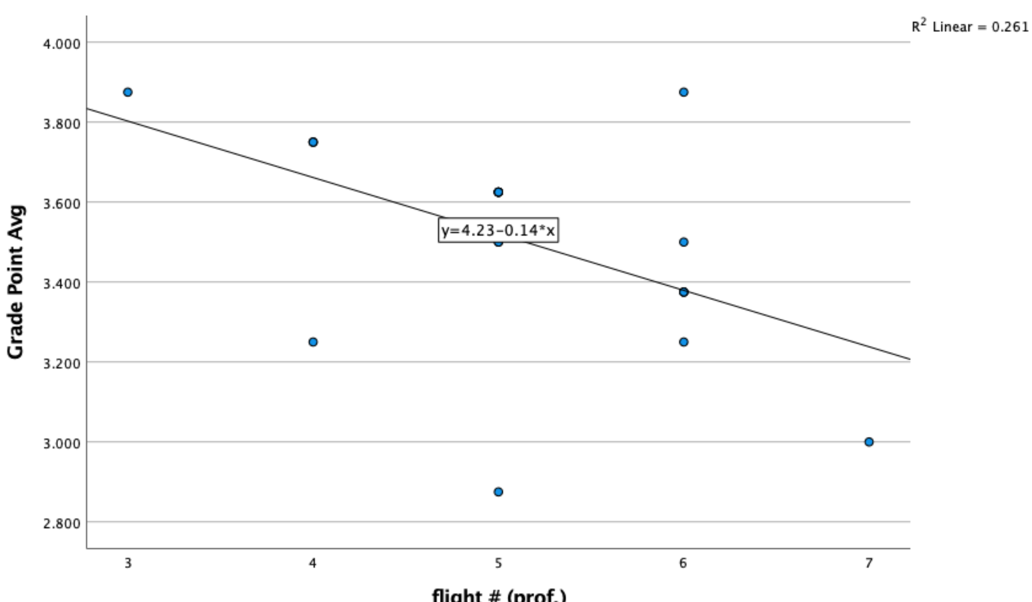


Figure 1. Grade Point Avg v. flight #

Research Question

What is the relationship between grade point average (GPA) in the instrument phase of training and flight number in which proficiency is achieved for students who receive AR/VR training in USAF pilot training?

Hypothesis

H_0 : P=0 There is no relationship between GPA in the instrument phase of flight and flight number in which proficiency is achieved for students who receive AR/VR training in USAF pilot training.

H_1 : P≠0 The is a significant relationship between GPA in the instrument phase of flight and flight number in which proficiency is achieved for students who receive AR/VR training in USAF pilot training.

Population Sample

The population is comprised of one class of 20 USAF pilot training students who have received AR/VR training, but could be enlarged to include multiple classes. The current analysis only includes one small phase of training comprised of eight instrument flights and the associated simulators, but could also be amplified to include student performance in all phases of pilot training. These students in pilot training represent a small sample of all students who have ever completed or are currently completing USAF pilot training (UPT), as there are five UPT bases and 15-16 classes every year.

Operational Definitions

Grade Point Average is defined as the average of the eight grades received for the eight flights in the instrument phase of training. The flight number in which proficiency is achieved is counted between the first flight and the eighth, or last flight in the instrument phase of training.

The results vary from achieving proficiency on the third flight all the way to the seventh flight, with the mean being 5.1.

Data Analysis

The data was analyzed using several different tests in SPSS. The first consisted of a scatter plot that showed linearity between the variables. The line on Figure 1 indicates a negative correlation, showing an inversely proportional relationship between the two variables. This can be attributed to the fact that the earlier many of these students achieve proficiency in this phase of training, the higher the GPA. Shapiro-Wilk analysis was conducted as a test of normality. Q-Q plots were also conducted as tests of normality, along with a Pearson Correlation to determine if the correlation between the variables was statistically significant.

Data Interpretation

As aforementioned, the line on the scatter plot indicates a negative relationship, or inversely proportional between the GPA and on what flight the student achieves proficiency. This indicates that students who performed better earlier in the phase of training tended to perform better throughout the whole phase of training. The slope of the line indicates that the relationship is moderate between the two variables.

The results for the Shapiro-Wilk test were greater than 0.05, satisfying the normality assumption for the data analyzed. Both Q-Q plots have the data very closely aligned with the diagonal line, also showing the normality assumption is satisfied. The results for the Pearson Correlation show that the results were statistically significant, $r(20) = .021$, $p < .05$ (Table 3). This shows a significant correlation between the two variables. Another study would have to be conducted examining all students, including those who do not receive the additional training, to determine if AR/VR training shows statistically significant improvement in student performance.

The angle of the slope indicates that there is a moderate relationship between the two variables. A student who receives AR/VR training and achieves proficiency earlier in the phase of training will have a higher GPA.

Summary of Research Findings

Table 1 Shapiro-Wilk Test of Normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
flight # (prof.)	.209	20	.022	.916	20	.082
Grade Point Avg	.172	20	.125	.931	20	.164

a. Lilliefors Significance Correction

Table 2 Descriptive Statistics for SPSS Assignment 5 Dataset

Descriptives

			Statistic	Std. Error
flight # (prof.)	Mean		5.10	.216
	95% Confidence Interval for Mean	Lower Bound	4.65	
		Upper Bound	5.55	
	5% Trimmed Mean		5.11	
	Median		5.00	
	Variance		.937	
	Std. Deviation		.968	
	Minimum		3	
	Maximum		7	
	Range		4	
	Interquartile Range		2	
	Skewness		-.217	.512
	Kurtosis		-.060	.992
Grade Point Avg	Mean		3.50625	.059793
	95% Confidence Interval for Mean	Lower Bound	3.38110	
		Upper Bound	3.63140	
	5% Trimmed Mean		3.52083	
	Median		3.56250	
	Variance		.072	
	Std. Deviation		.267404	
	Minimum		2.875	
	Maximum		3.875	
	Range		1.000	
	Interquartile Range		.344	
	Skewness		-.825	.512
	Kurtosis		.453	.992

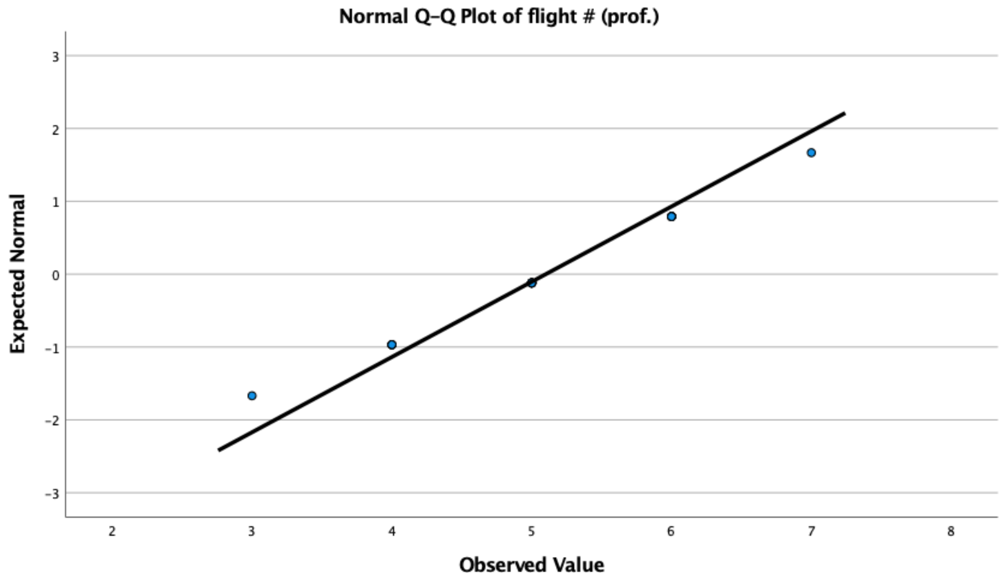


Figure 2. Q-Q Plot of flight # proficiency

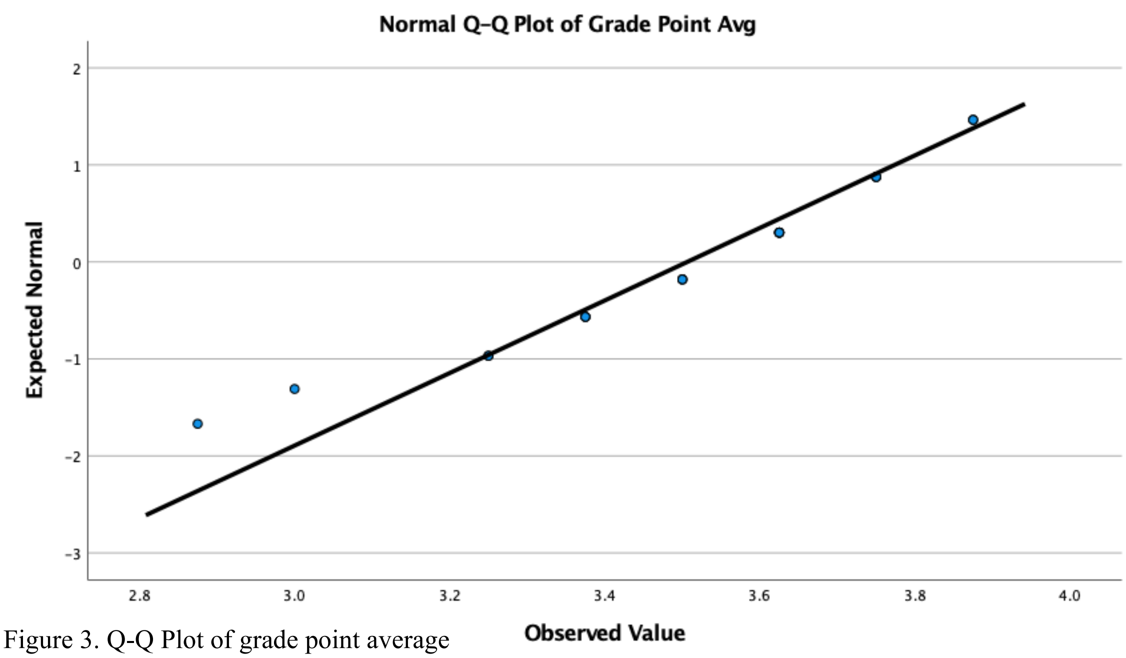


Figure 3. Q-Q Plot of grade point average

Table 3 Pearson Correlation for SPSS Assignment 5 Dataset

Correlations

		flight # (prof.)	Grade Point Avg
flight # (prof.)	Pearson Correlation	1	-.511*
	Sig. (2-tailed)		.021
	N	20	20
Grade Point Avg	Pearson Correlation	-.511*	1
	Sig. (2-tailed)	.021	
	N	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

Conclusion

The conclusion of this study shows that there is a significant correlation between the two variables described, thus the null hypothesis is rejected. Using the data sampled there was an impact in how well a student performed based on receiving AR/VR training and performing well earlier in the instrument phase of training. This is a positive result that speaks to continuing with AR/VR assisted training throughout USAF pilot training.

This training is a very rigorous program, and results often vary in student performance based off of many different variables. With the right assumptions and keeping in mind certain limitations of the scope of the study, it would be possible to sample larger groups of students and perform statistical analysis of more phases of training in an attempt to broaden the statistically significant data results. If the data supports increased student performance with AR/VR training, this can be of real value to the USAF, as it can result in increased performance at a faster pace and decreased costs.

References

Air Education Training Command (AETC) (2021). AETC / ENJJPT Syllabus P-V4A-N (T-6) https://community.apan.org/cfs-file/__key/docpreview-s/00-00-19-62-50/AETC-ENJJPT-Syllabus-P_2D00_V4A_2D00_N-_2800_T_2D00_6_2900_-APR-21-POST-TQRB.pdf

Coleman, J., & Thirtyacre, D. (2021). Remote pilot situational awareness with augmented reality glasses: An observational field study. *International Journal of Aviation, Aeronautics and Aerospace, 8*(1), 3. https://ezp.slu.edu/login?url=https://www-proquest-com.ezp.slu.edu/scholarly-journals/remote-pilot-situational-awareness-with-augmented/docview/2488140980/se-2?accountid=8065

Privitera, G. J. (2017). *Statistics for the behavioral sciences* (3rd ed.). Sage Publications.

Linear Multiple Regression

1. Purpose Statement

   The purpose of this study was to determine the relationship between Augmented Reality and Virtual Reality (AR/VR) training in an Air Force Pilot Training program and student pilot performance, taking into account several factors like age, phase of flight, previous flight training, previous exposure to AR/VR devices, and number of AR/VR training events.

2. Variables (Predictors)

   Predictors
   - Age
   - Phase of flight
   - Previous flight training
   - Previous exposure to AR/VR devices
   - Number of *ARNR* training events

3. Dependent Measures

   Student pilot performance in the sample pilot training classes, as measured by the grades achieved at the end of each phase of training during pilot training.

4. Operational Definitions

   Age denotes the difference in age, which can be up to a 9-year gap, and can be significant as younger students may be more likely to adapt quicker to AR/VR devices. The phase of flight relates to the different stages of training during pilot training, which can be impacted at varying levels by additional training in AR/VR. Previous flight training can be as little as 20 hours in USAF Introduction to Flight Training, or over 1,000 hours and a Commercial Pilot Rating. Previous exposure to AR/VR devices, even if not flying related, can be advantageous as it is a new method of learning that can take some getting used to. The number of AR/VR training events indicates how many events or simulators with AR/VR capability the student has performed.

5. Research Questions

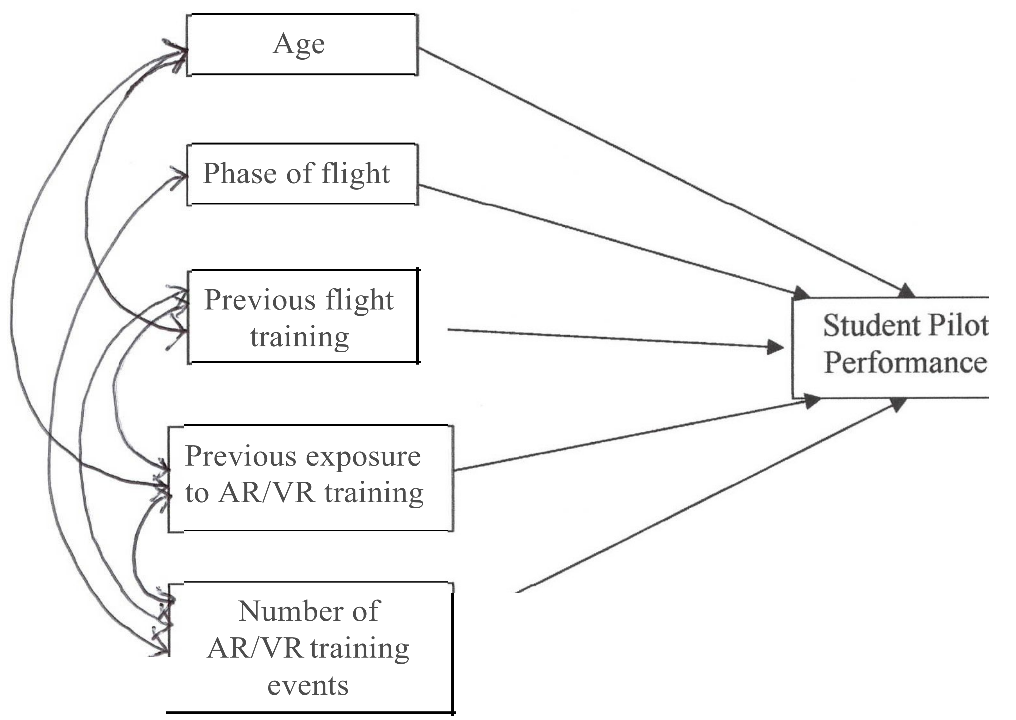
   What is the relationship between AR/VR training in Air Force Pilot Training and student pilot performance, taking into account several factors like age, phase of flight, previous flight training, previous exposure to AR/VR devices, and number of ARVR training events?

6. Statistical Hypotheses

   HO: p = 0 There is no significant relationship between AR/VR training in Air Force Pilot Training and student pilot performance, taking into account several factors like age, phase of flight, previous flight training, previous exposure to AR/VR devices, and number of ARVR training events?

   H1: p *i-* 0 There is a significant relationship between AR/VR training in Air Force Pilot Training and student pilot performance, taking into account several factors like age, phase of flight, previous flight training, previous exposure to AR/VR devices, and number of ARVR training events?

7. Path Display



Linear Multiple Regression

Pearson Correlation SPSS

Quiz 12

May 13, 2022

Linear Multiple Regression

A correlational study of the effects of pilot and crew training on combating aircraft cyber-attacks has been presented to describe how each variable affects the other.

Purpose statement

This study aimed to determine the relationship between pilot and crew training and aircraft cyber security attacks. The various factors considered in the study included; pilot training results, crew performance outcomes, the aviation institution, technological advancement, flight numbers, types of aircraft, qualification of pilots, number of crew on board, and the cyber aircraft reports

Variables

The predictors included:

- Pilot training results
- Crew performance results
- Aviation institutions
- Technological advancement
- Flight numbers
- Types of aircrafts
- Pilot qualifications
- Number of the crew on board

Dependent measure

The dependent measure is the number of aircraft cyber-attacks in the aviation industry available from the Federal Aviation Administration (FAA) database.

Operational definitions

The pilot training results involved the performances of individual pilots when the cybersecurity training was conducted in various aviation institutions. These results were recorded, and pilots were graded based on their outcomes. The crew performance outcomes involved the performances of every crew on board and the staff working on different airplanes and aircraft on their preparedness to handle the cyber-attacks on the planes (Patel, 2017). The aviation institutions are accredited learning institutions that offer the training to both the crew and pilots to assess their preparedness to handle the various attacks when they are experienced.

The aviation institutions are further classified as either private or public. The public aviation institutions are controlled and funded by the government and offer training at subsidized charges (Federal Aviation Administration, 2017). Private aviation institutions are those learning centers that have been given the power to operate but under the management of private entities. The technological advancement in this study referred to changes and improvements in technology application which has contributed to an increase in aircraft cyber-attacks. The technological advancement witnessed was primarily from human-induced activities and other natural factors.

The flight numbers represented the various flights operating in the Triple E, Colorado airlines, obtained from the FAA database for the last five years. The aircraft types involved the designs, nature, size, and the purposes of the different aircraft in the aviation industry (Johnson, 2019). Pilot qualifications are the basic requirements that the pilots must have obtained before being licensed to operate the aircraft. The qualification of various pilots was assessed based on their academic, professional, and working experience across multiple airline operations. The aircraft cyber-attacks included the outcome of all the factors and the results from different independent variables.

Research question

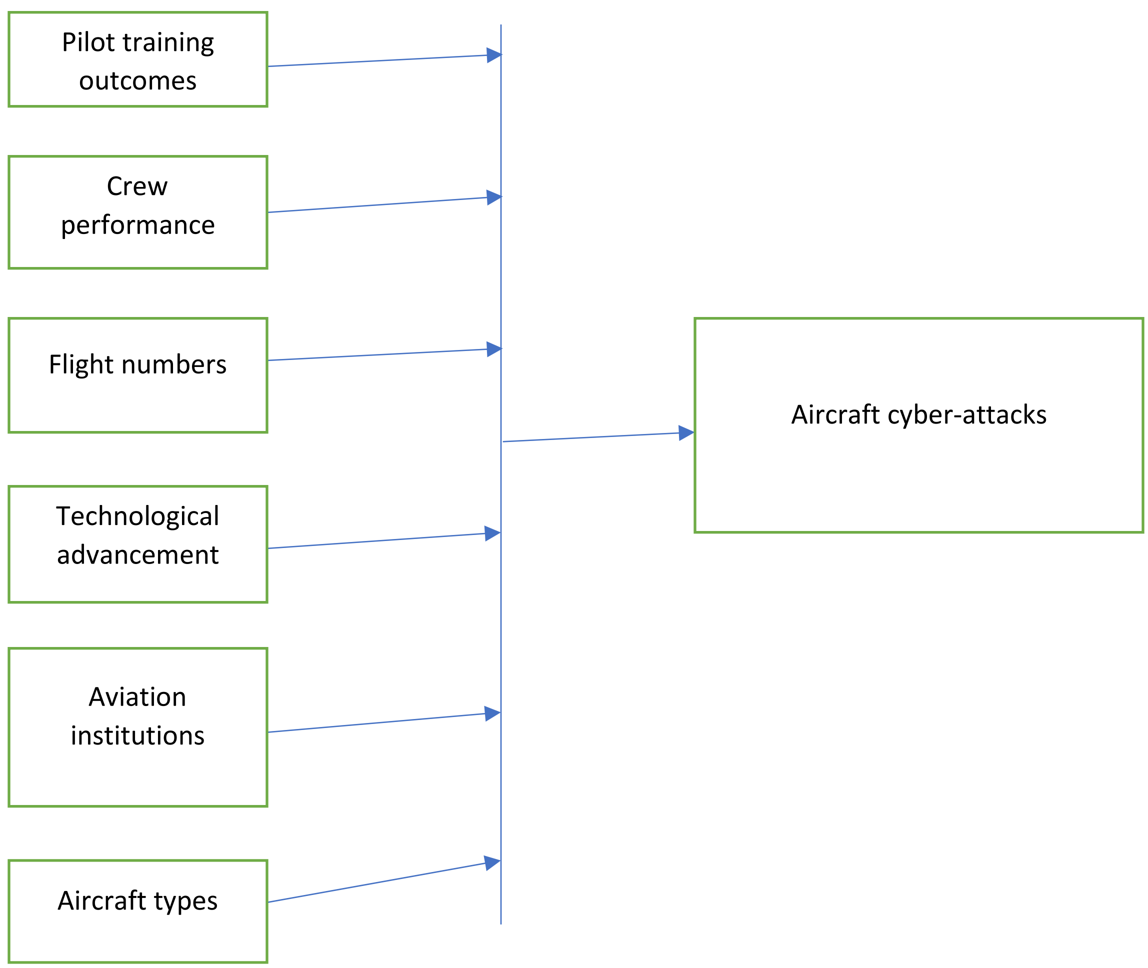
What is the relationship between combating the aircraft cyber-attacks in the Triple E, Colorado, and various factors such as pilot training outcomes, crew performance results, flight numbers, technological advancement, and the aviation institutions available?

Statistical hypotheses

H0: ρ = 0, There is no significant relationship between combating the aircraft cyber-attacks in the Triple E, Colorado, and various factors such as pilot training outcomes, crew performance results, flight numbers, technological advancement, and aviation institutions available.

H1: ρ ≠ 0, There is a significant relationship between combating the aircraft cyber-attacks in the Triple E, Colorado, and various factors such as pilot training outcomes, crew performance results, flight numbers, technological advancement, and the aviation institutions available

Path display



References

Johnson D. P. (2019, August 30). Civil aviation and cybersecurity. *Honey-well Aerospace Advanced Technology*, 56-59. Retrieved from http://www.aviationtoday.com/2016/12/29/raytheon-is-working-onan-airplane-cyber-attack-warning-system

Federal Aviation Administration. (2017, June). Aircraft cybersecurity: The pilot's perspective. *Air Line Pilots Association*, 1-8. Retrieved from; https://www.alpa.org/-/media/ALPA/Files/pdfs/news-events/white-papers/white-paper-cybersecurity.pdf?la=en

Patel, R. (2017, March 21). Managing cybersecurity risk in weapon systems. *Aircraft Systems Authorizing Official, US AIrforce, LCMC*, 36-46.

Graduate Course Performance Indicator Rubric

Assess Student Learning Outcomes

Course: ASCI 6010 Federal and International

Course Instructor:____Janice McCall____________________________

Semester Taught: ___Spring 2022_______________

Number of Students in Course:__1____

Student Learning Outcome Assessed	Assessment Results: (Indicate what % of class achieved a minimum score of 80%)	Benchmark achieved? (Benchmark: 80% of students will score a minimum of 80% = "B")
SLO 2: Apply the major practices, theory, or research methodologies in the aviation field of study.	100%	Yes
SLO 4: Articulate arguments or explanations to both a disciplinary or professional aviation audience and to a general audience, in both oral and written forms.	100%	Yes

Course Assessment (Intended Use of Results)
The following will be used for recommendations to improve the quality of course delivery based on assessment results. These recommendations may include prerequisite change; changing course outline and adding more topics; adding a third assessment; changing the course sequence, etc.

NOTE: In SLO 4, I did not require the student to provide an oral presentation. Nonetheless, through engagement on the Discussion Board the student demonstrated the ability to clearly and succinctly articulate a cogent argument.

**Attach description of assignment used for assessment and samples of student work.*

SLO 2: Apply the major practices, theory, or research methodologies in the aviation field of study.

ASSIGNMENT SLO 2

Intro to Mod 4

Intro to LM:

In the last learning module, we looked at how regulations are created for the aviation industry within the USA and abroad. The World Justice Project (2021 (Links to an external site.)) emphasizes that "regulations, both legal and administrative, structure behaviors within and outside of the government." Therefore, strong rule of law necessitates that such regulations and administrative provisions are enforced effectually, and are applied and enforced without inappropriate influence by public officials or private interests (World Justice Project, 2019 (Links to an external site.)). In Module 4 we explore the process of enforcing these regulations in the U.S.A versus the process in the European Union.

"Enforcement is the process of ensuring compliance with laws, regulations, rules, standards, and social norms" (Juliano, 2019 (Links to an external site.)). In the U.S.A. this function falls to the FAA, for the E.U. it is EASA and E.U. member states. Throughout the world, National Aviation Authorities or Civil Aviation Authorities, have the mandate to investigate conduct that violates statutes, or regulations, under their control.

Note that this Module is intended as an overview of enforcement rather than an in-depth exploration of specific types of fines, actions, and penalties, which will be covered through discussion in Module 5.

There is one assignment for this LM:

- Short paper due 13 March 2022 (possible 60 points) Due date extended to 20 Mar2022
    - 3-5 page paper comparing and/or contrasting enforcement process between FAA, EASA's memberstates.
    - Follow the short paper formatting requirements and sample paper
    - Submit the paper by attaching a Word document to the assignment link

STUDENT SAMPLE SLO 2

Amy Preis
ASCI 6010
20 March 2022

Rise of Unruly Passengers and Regulatory Response

Verbal abuse, threatening behavior, and physical aggression from airline passengers is sadly becoming more and more of a reality for airline crew members. In February 2022, a passenger on American Airlines Flight 1775 from Los Angeles to Washington, D.C. attempted to open the main cabin door in flight after threatening crew with escalating, aggressive behavior. In order to subdue the perpetrator, a crew member resorted to bludgeoning the unruly passenger with a coffee pot while other crew and passengers restrained him with tape and zip ties. The flight ended with an emergency landing in Kansas City and authorities waiting to collect the perpetrator at the gate (Chung & Lukpat, 2022). While this incident made headlines and stands out, such dangerous behavior from passengers presents a continual threat to airline crew members and the traveling public.

Commercial air travel has seen a rise in unruly passenger incidents over recent years. The International Civil Aviation Organization (ICAO) defines 'unruly passengers' as:

> Passengers who fail to respect the rules of conduct on board aircraft or to follow the instructions of crew mem[illegible] thereby create a threat to flight safety and/or disturb the good order and discipline on board aircraft. (ICAO, 2019, Section 1.1)

There have been unruly passenger incidents since passengers began flying on board commercial aircraft. The international aviation industry first recognized threats presented by unruly passengers in the Tokyo Convention of 1963. Recently, the industry has seen a spike in unruly passenger events amidst the global COVID-19 pandemic, with a total 5,981 unruly passenger reports in 2021 (FAA, 2022).

Jan McCall
2022-03-14 12:20:00

First, this is fine.
Lol! This stirred a debate at our house this morning. The APA rule is 40 words or longer for block quotes. You have 38 words, which led to the question of whether the 40 includes the citation. I argue yes and my spouse no but we never found an answer. This is what

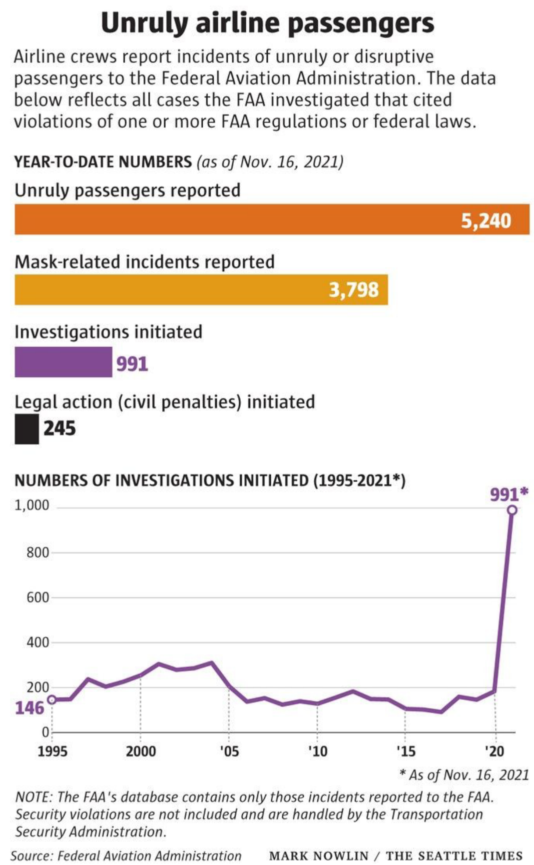


Figure 1 (Shankar, 2021)

It is assumed the real number of incidents exceeds the rate tracked by the United States' Federal Aviation Administration (FAA), as data not reported by a crewmember is not reflected in the FAA tracking system. Globally, airlines and air crew members are calling for stronger methods of deterrence, beyond what currently stands, to combat the wave of unruly passengers seen in recent years. Such incide threats not just to crew members, but to other passengers, the flight, and the global aviation system at large.

The United States and the FAA's Response

Jan McCall
2022-03-14 12:32:00

Nice summation and transition.

The United States Federal Aviation Administration (FAA) has a series of processes it works through to impose regulatory compliance among passengers. At its disposal are legal enforcement actions through civil penalties, administrative actions through warning notices or compliance actions including counseling (FAA, 2022). Prior to the COVID-19 Pandemic's beginning, the U.S. Congress issued a Reauthorization Bill which increased the proposed maximum civil penalty for unruly passengers to $37,000 from $25,000 per offense. In 2021, the FAA released a new Zero-Tolerance policy, which offered it the ability to impose fines without a warning and the option for the Administration to refer unruly passengers to the Department of Justice for criminal charges (FAA, 2021, Change 7). The FAA also launched a social media and advertising campaign to inform the general public of these reforms, warning against disruptive behaviors in flight:

Jan McCall
2022-03-14 12:37:00

FAA or Congress issued Reauthorization Bill?

Figure 2: Social media and advertising signage (FAA airport digital signage, 2022)

Even amidst the threat of up to a $37,000 fine from the FAA and criminal prosecution, unruly passenger incidents on 2018 (FAA, 2022). The majority of incidents in 2020 and 2021 related to compliance with COVID-19 mask regulations. The conclusion is that even in the face of large fines and the threat of criminal prosecution, such behavior aboard aircraft has not significantly deterred.

The European Union and EASA's Response

While the United States' response to unruly passengers works through the FAA and its own legal systems, the European Union signed an international agreement between many nations to act against unruly passengers. The Montreal Protocol 2014 (MP14) took effect at the beginning of January 2020, and gives authorities in an aircraft's arrival country authority to prosecute unruly passengers (Wood, 2019). Previously, the country to which the aircraft was registered was responsible for prosecuting unruly passengers. In effect, this meant t law enforcement in an arrival country to meet the passenger at the gate and no true incentive to dedicate time, resourc to finding and penalizing an unruly passenger. Similar to the situation in the United States, prior to MP14, research fo on board flights were going unpunished (Wood, 2019). The treaty allows for more immediate repercussions for unrul for countries to intervene and provide punitive penalties.

The effectiveness of MP14 is yet to be seen, though. Despite MP14's launch at the beginning of 2020, unruly passenger incidents continued to increase through 2020 and into 2021, and just 32 out of 193 ICAO member states had ratified MP14—meaning only about one-third of international traffic is expected to be covered by the treaty (IATA, 2021). The COVID-19 Pandemic has continued to exacerbate unruly passenger incidents in flight and the penalties for these actions do not appear to prevent such behavior from passengers. The United States has yet to sign MP14, and until the majority of countries around the world come to agreement on an effective multilateral treaty, the aviation industry lacks a global standard for unruly passengers in airline travel.

Jan McCall
2022-03-14 12:41:00
Add the amount "Of up to $37,000, and year

Jan McCall
2022-03-14 13:02:00

Jan McCall
2022-03-14 13:03:00
APA 7th includes serial comma (Oxford

Jan McCall
2022-03-14 13:04:00
Excellent point on lack of investigation and

Moving Forward

The legal means are in place to give regulatory bodies authority to take punitive action against unruly passengers. The nature of seeking justice through the legal system, however, involves time, costs, and coordination efforts to gather information and present a case—a reality that means legal reaction is slow and ineffective. In the United States, legal experts note that while federal agencies have t[illegible]y, and a multitude of legal tools, to prosecute against unruly passengers, there is a need to invest resources into making sure that process of enforcement is well-funded and considered a priority among all authorities (Keithley, 2022). As such, the punitive measures being taken are not significantly deterring dangerous behavior among unruly passengers, presenting a continued threat to the safety of flight.

Globally, airlines and the International Air Transport Association (IATA) are calling for swifter, more decisi[illegible]e actions against unruly passengers. Steeper fines in the U.S. and more widespread enforcement abilities in the E.U. are not providing enough [illegible] behavior. From IATA, there are calls for the global community to prosecute passengers criminally for such disturbances (Schengenvisainfo News, 2021). Airlines within the U.S. are petitioning the Department of Justice to include unruly passengers on a national no-fly list, a list which currently prevents suspected terrorists and extremists from boarding an aircraft (Shepardson, 2022). Such an action would prevent passengers that were deemed unruly in one incident from boarding any U.S. airline flight. Terrorists typically act upon political or ideological motivations and carry out premeditated acts, where unruly passenger incidents tend to be in reaction to stressful situations and often involve alcohol consumption. Grouping badly behaved passengers and terrorists under the same policy could present legal and operational conflicts. The No-Fly list, as it stands, poses civil liberty implications and has already been challenged in court numerous times (Sampson, 2022). A federal unruly passenger list would likely bring similar legal challenge and discourse.

Jan McCall
2022-03-14 13:08:00
Add commas
Authority, and a multitude of legal tools, to

Jan McCall
2022-03-14 13:10:00
Make this stand out by pointing out the problem [illegible] to the safety of flight." Also, instead poor behavior" maybe aggressive or dangerous behavior. Something along that line.

Jan McCall
2022-03-14 13:12:00
U.S. and E.U.
It is annoying but required.

As unruly passenger incidents continue to trend upward, immediate action is needed. This includes continued pressure on all ICAO members to ratify MP14 and bolstering federal agencies' abilities to investigate and prosecute unruly passengers. While regulatory bodies continue to issue new rulings, their ability to quickly prosecute individuals may aid in effectively deterring other negative behaviors. At the same time, global conditions, such as the highly stressful ongoing coronavirus disease of 2019 (COVID-19) pandemic, create en likely to continue to influence passenger behavior. The key will be in finding an appropriate equilibrium between the hazards presented by unruly passengers and an effective response from government and industry to curb dangerous behaviors.

Jan McCall
2022-03-14 17:38:00

...stressful ongoing coronavirus disease of 2019 (COVID-19) pandemic, ...

References

Jan McCall
2022-03-14 17:41:00

Bold References

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Jan McCall
2022-03-14 17:46:00

Reviewers disagree on the use of abbreviations. I defer to Purdue OWL (2022) which says: "You should not overuse abbreviations (writing is easier to understand when words are written out); you should also not underuse abbreviations (in general, if you use an

Keithley, G. (2022). The Federal Powers to Fight Back Against Unruly Airline Passengers. *The Air and Space Lawyer*, *34*(3), 6-9. https://www.americanbar.org/content/dam/aba/publications/air_space_lawyer/winter2022/v034n03keithley.pdf

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Jan McCall
2022-03-14 17:51:00

Govts

Jan McCall
2022-03-21 15:02:00

Change to Nowlin. Click on the image in the SeTimes and use the image URL.

Amy, this is absolutely a great paper and a well-researched topic. It was a pleasure to read as I had my coffee this morning.

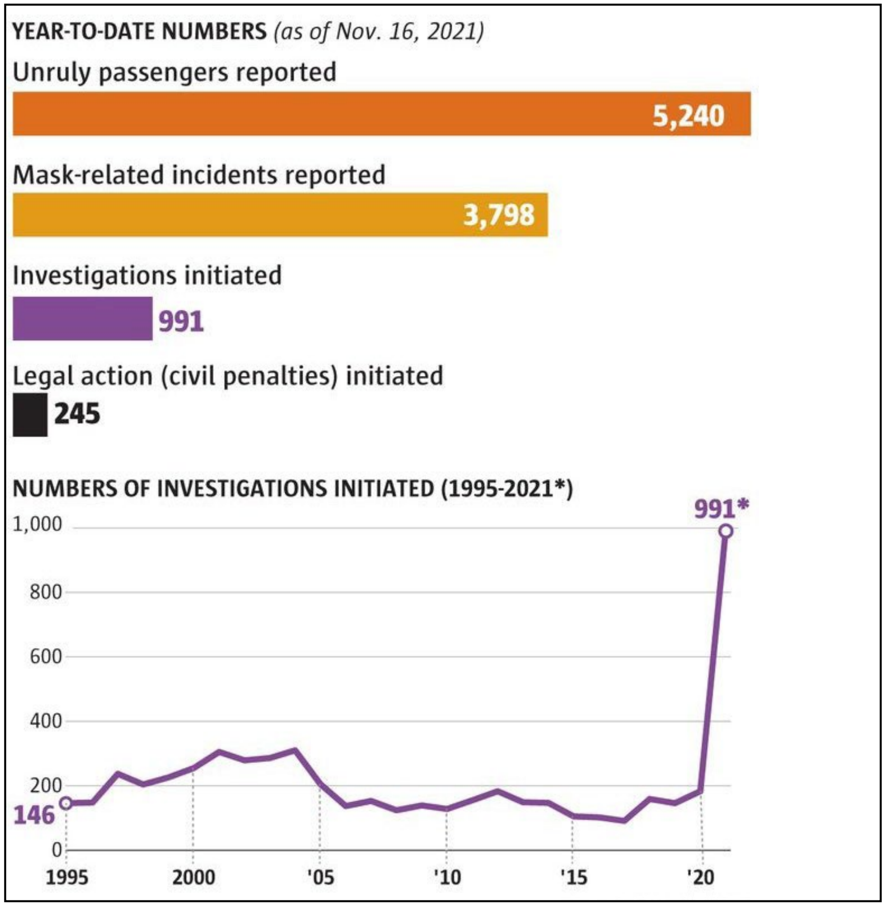
Grade: 59/60

It is always nice to see what a few revisions can do to strengthen what was already a good paper. That is certainly the case with your revisions and additions to this paper. With a couple of tweaks, you should definitely include this in your portfolio.

I love the figures! I encourage you to include at least one in papers since some people absorb information from images and figures more easily than text, plus it lends credibility to your work. APA 7th made big changes in how figures are presented (See Purdue OWL APA Student Sample Paper). I've modified your figure below as an example you can use to make changes for future papers.

Figure 1 *[2nd level heading, flush left, bold, and title case]*

Unruly Airline Passengers [Title of Figure, italicized]



Note. Reproduced from Nowlin (2021, November 22) as published in *The Seattle Times*. The data depicts all cases the FAA investigated that referred to one or more violations of regulations, or federal laws, by unruly passengers. The FAA's database includes only the incidents reported to the FAA and does not incorporate security violations that are handled by the Transportation Security Administration (para. 4).

Notice that I cropped out much of the text and paraphrased it on the note at the bottom, hence the "para. 4." This allows you to increase the size of the image to more closely match the paper's text font. Think of 10 as the minimum font size for readers that like to print papers.

I put in a basic black border so the figure stands out from the paper's white background. In the note, I clearly state that the image is "reproduced" and cite the ***artist****, Nowlin, not the author of the article. You'll need to change the reference to Nowlin as well. Adjust both figures to this format before including the paper in your portfolio.*

Now is the time to decide on your final paper topic and get started doing the research. Keep up the great work in the class.

Jan

SLO 4: Articulate arguments or explanations to both a disciplinary or professional aviation audience and to a general audience, in both oral and written forms.

ASSIGNMENT SLO 4

Mod 3 DB: The U.S. and E.U. Regulatory Environment: Government Regulation of the Airline Industry

Janice McCall

Chose **two questions** to answer from the list below. Limit your answers to 2-4 paragraphs. Responses and replies to others are due by the end of the module on 27 FEB and are worth a total of 60 points. Please use weblinks for source citation in lieu of references.

Post early enough to allow time for others to review and respond. The best approach is to post early and then spend time discussing the topics with the class. Take time to review and engage peers on their responses.

- What are a few of the differences between the US and EU rulemaking processes and implications for the aviation industry?
- How do nations work together to create the regulatory environment by setting regional or global standards in a particular area (choose something like environmental, health, free trade, etc.)?
- Imagine what aviation would be today without ICAO, then describe how aviation coordination between nations might occur.
- Over the past few years, the accidents surrounding the Boeing 7373 Max beg the question of how nations determine the airworthiness of commercial aircraft. Explain the process that ensures an aircraft certified in one country meets the requirements of another.
- How are crew standards developed and incorporated to provide one level of safety worldwide? Consider differences in training standards, medical standards, age, abilities, etc..

STUDENT SAMPLE SLO 4

Amy Preis (Q1)

Feb 25, 2022

What are a few of the differences between the US and EU rulemaking process and implications for the aviation industry?

One of the most notable differences between the US and EU's aviation rulemaking process is where each body derives its authority. In the US, the Federal Aviation Administration is charged with ensuring the safety of civil aviation in the United States through the Federal Aviation Act of 1958 (Public Law 85-726, 1958 (Links to an external site.)). The FAA's Administrator's authority to issue rules regarding use of airspace is found in 49 U.S.C. 40103. It is through the United States legislative branch that the FAA is granted authority to oversee rulemaking in the United States. Conversely, the European Union is a cooperation of 27 member states, and through this agreement of nations, established the European Aviation Safety Administration (EASA) to oversee its aviation rulemaking and works with member nations to implement regulations (EASA, 2022 (Links to an external site.)). EASA replaced the Joint Aviation Authority and member states regulating their own aviation regulations, due to varying interpretations and differences in rules across member states. With the establishment of EASA, instead of deriving its authority from one country or government, EASA derives its rulemaking authority from the conglomerate agreement of nations within the European Union. In the aviation industry, that may present complications given language barriers, different governments' interests, and the bureaucracy of regulating on behalf of numerous countries. Even with the establishment of a singular aviation regulatory body, the EASA represents 27 countries while the FAA serves one.

Often, in the US, the Aviation Rulemaking Advisory Committee (ARAC), a standing committee, offers recommendations for potential rulemaking actions to address perceived problems and specific areas of concern (14 CFR Part 11.27 (Links to an external site.)). Meanwhile, EASA establishes a 5-year rulemaking priorities list that drives its rulemaking process over the subsequent years and establishes the various rulemaking projects that the agency will undertake (European Aviation Safety Agency, 2015 (Links to an external site.)). Referencing back to the numerous countries that EASA represents, establishing a 5-year "to do" list for rulemaking likely makes the endeavor organized and keeps all members of the EU on the same page–but that may also mean that opportunities to undertake differing rulemaking projects may have to wait until the next five year cycle.

In the US, once a rulemaking project is determined by the Administrator, The FAA relies on input from ARAC and other established committees in various rulemaking projects (Advisory and Rulemaking Committees, n.d (Links to an external site.) & Advisory and Rulemaking Committees List, n.d (Links to an external site.).) Conversely, EASA will assemble a rulemaking group based on the specifications of its rulemaking project, determined by the Executive Director (EASA Management Board Decision, 2015 (Links to an external site.), Article 4.4). Thus, in the US, the committee involved in one rulemaking project could contribute to another project, while EASA assembles a new committee based on the project–and at the discretion of the Executive Director. ARAC, meanwhile, is also able to bring a rulemaking project to the attention of the Administrator and be a part of the rulemaking project itself. The differences between the way each regulatory body assembles and utilizes committees of stakeholders has the opportunity to change the way the regulatory body and the industry itself interacts with those committees.

- Janice McCall

  Feb 26, 2022Feb 26 at 2:39am

  Wonderful Amy. I see you really spent time researching the differences.

  Do you think the ARAC brings the same expertise compared to the EU assembly of various experts when proposing new or rule changes?

  Jan

Amy Preis

Feb 26, 2022Feb 26 at 5pm

Thank you, Jan. I found myself in the weeds a few times, so I'm glad it made sense.

I imagine that the FAA's ARAC is especially tuned into the rule making process; the committee exists for that purpose. Compared to the EU assembled groups, that would have an advantage of familiarity of standing regulations and the possibilities to adopt future regulations. Conversely, the EU assembled group likely involves more experts in the relevant field, since they are assembled explicitly for that rule making project. The EU assembled group, I imagine, would have more of a practical knowledge of how those regulations play out in industry.

I'm viewing the comparison as 'career politicians' vs. 'grassroots-elected politicians'--though I may be completely wrong. If that is the case, however, the FAA's method probably makes for a smoother rule-making process; EASA's method may bring people to a committee who have not worked in rule making before (and bring a whole different working perspective to it).

- Janice McCall

Feb 26, 2022Feb 26 at 7:18pm

Amy, I like your analogy of career politician vs grassroots. The ARAC may have the rulemaking process down but could lack some of the expertise and familiarity with real-world implications.

I'm not sure how or what role lobbyists play in EU rulemaking. In the US, lobbyists for airlines, trade unions, aviation orgs, etc., play a prominent role in rulemaking.

Jan

Amy Preis

Feb 27, 2022Feb 27 at 4:33pm

Ah! Yes, cannot forget our lobbyists' power. Side tangent, but I was just talking with someone about the possibility of a hyperlink rail system between St. Louis and Chicago, and the power of the airline lobby that killed it about 6-7 years ago. I expect that is still the case with that specific project.

Amy

Amy Preis (Q2)

Feb 26, 2022Feb 26 at 4:53pm

How do nations work together to create the regulatory environment by setting regional or global standards in a particular area (choose something like, environmental, health, free trade, etc.)?
The global aviation system maintains a similar standard of safety and impact globally through guidance from the International Civil Aviation Organization (ICAO). ICAO provides Standards and Recommended Procedures as guidance, and recommends that member states have a national level organization to oversee aviation safety oversight within each country. SARPs (or amendments) are implemented following ⅔ of Member States' support, meaning that these standards are agreed to by a majority of member states. ICAO also utilizes Resolutions adopted by its member states to agree upon global standards in a particular area. Resolutions aren't quite 'rules' for civil aviation with actionable consequences, but are instead agreed-upon goals. When the ICAO Assembly of 193 member states meets every three years, resolutions may be adopted to guide future amendment actions that all member states may pursue (United Nations, 2021 (Links to an external site.)).

Recently through ICAO, member states have agreed that one of three main areas of collaboration will be climate change and aviation admissions. In 2019 at its 40th ICAO Assembly Session, member states voted to adopt Resolution A40-18 that (ICAO Environmental Protection, 2021 (Links to an external site.) and Resolution A40-18, 2019 (Links to an external site.)). Resolution A40-18 re-established previously stated and agreed upon resolutions surrounding the role that aviation plays in climate change, necessary limits on harmful emissions, as well as recognizing that sustainable growth of the industry globally will require a "comprehensive approach, consisting of a basket of measures including technology and standards, sustainable aviation fuels, operational improvements and market-based measures to reduce emissions" (Resolution A40-18, 2019 (Links to an external site.), page 2, paragraph 5). The Resolution, as well as environmentally-related Resolutions A40-17 and A40-18, requests that ICAO study policy options to reduce aircraft engine emissions and develop proposals that encompass solutions for member states to adopt (Resolution A40-18, 2019 (Links to an external site.), page 4, Section 2.b).

With this resolution as guidance, or as a goal, member states may tailor their own actions, research and development, and national resources to meet the agreed-upon benchmarks. For example, the ECAC/EU Emissions Reduction Task Group (including representatives from EASA and EU member states) has publicized a commitment to create an action plan related to the Resolution that will ensure Europe's compliance (ECAC News, 2020 (Links to an external site.)). Similarly, in the US, NASA was found to have used the carbon reduction goals of Resolution A40-18 as guidance for its

sustainable aviation strategy (Kenyon, 2021 (Links to an external site.)). With the agreed upon Resolution, member states set a goal that the industry around the globe is working toward in tandem.
Setting these goals establishes a blueprint for future ICAO Standards and Procedures to be developed. There already exists Annex 16 Volume IV, effective October 22, 2018, that encompasses the global Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (ICAO Environment Annex 16 Volume IV, n.d. (Links to an external site.)). The future opportunity exists for ICAO Member States to include strategies and policy that result from Resolution A40-18 into Annex 16 as well.

- Janice McCall
  Feb 27, 2022Feb 27 at 6:32am
  Amy, COVID gave us a brief glimpse of how air quality improves with reduced emissions from aircraft, and of course other sources. Not only, do I appreciate the comprehensive and agreed upon goals laid out by ICAO, I also see hope in recent research. Just last year, Grewe et al. (2021, June 22 (Links to an external site.)) found that "ICAO's offsetting scheme, CORSIA, will surpass the climate target set to support the 1.5 °C goal between 2025 and 2064 with a 90% likelihood."

  When I was a kid in Southern California, in the 1970s, there was a joke that told the scary state of air quality back then. "What is the difference between San Bernardino and Los Angles? In San Bernardino, you can see what you are breathing, and in Los Angles you can walk on it." From the mountains, you could see a thick brown layer of smog covering the valleys.

  Over the years, beginning as early as 1966, California began introducing control strategies that have worked. In 2011. I returned to California and was relieved to see the change. As I drove around the mountains, the sky was beautifully clear and the buildings and farms in the valley were in full view. Having seen the change implementing controls made in California, I am hopeful for the direction aviation has chosen towards protecting the environment and a sustainable future.

  Jan

- Amy Preis
  Feb 27, 2022Feb 27 at 4:38pm

That is very promising research surrounding CORSIA! I am sad to say that researching this question was the first time I'd heard of CORSIA and the actionable climate goals set through ICAO.
Your California example speaks to the optimist side of me. There is a lot of power in aligning policy and resources with effective goal-setting, that in the long run can pay off. I hope that every country that stated verbal agreement to these goals in the Resolution are sincerely invested in effecting change as well.

Amy