SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program Name (no acronyms): Master's in Aviation	Department: Oliver L. Parks Department of Aviation Science
Degree or Certificate Level: Masters	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 – Apply mathematics, science, and applied sciences at a level appropriate to aviation-related disciplines at the master's level, including an adequate foundation in statistics.

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

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 are able to apply mathematics, science, and applied sciences at a level appropriate to aviation-related disciplines at the master's level, including an adequate foundation in statistics.

6. Closing the Loop: Dissemination and Use of Current 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

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

Assessment of M.S. in Aviation Student Learning Outcomes

Student Learning Outcome #1: Apply mathematics, science, and applied sciences at a level appropriate to aviation-related disciplines at the master's level, including an adequate foundation in statistics.

Date of this assessment:

Performance Indicator Assessed	Do not Meet	Meet
Students and graduates develop preliminary skills in statistics needed to conduct research in aviation.		**X**
Students and graduates discuss the fundamental underpinnings of both qualitative and quantitative research methods.		**X**

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

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

Graduate Program Assessment – MS in Aviation

Continuous Improvement Items

06-23-2022

Course	Student Learning Outcome	Action Item
ASCI 5010 Introduction to Aviation Research Methods	SLO #1 - Apply mathematics, science, and applied sciences at a level appropriate to aviation-related disciplines at the master's level, including an adequate foundation in statistics.	Raise level of rigor by requiring a term paper

SAINT LOUIS UNIVERSITY

OLIVER L. PARKS DEPARTMENT
OF AVIATION SCIENCE

Appendix A

M.S. in Aviation

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.	<u>Precis Average Scores</u> 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.	<u>Assignment Average Scores</u> 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).

Examples SLO 1

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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 enhancing 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 conduct 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).

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 significantly when 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, I think 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:

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?