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Extended Reality in Flight Attendant Initial Training

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16. Abstract

Introduction. The purpose of this study was to determine if the addition of extended reality (XR) to an existing training program provided to new hire flight attendants improved training effectiveness in terms of cabin door procedures. **Methods.** This retrospective cohort study used preexisting flight attendant training data provided by a collaborating organization. The data were divided into two groups, the AQP-only control group, and the AQP+VR intervention group. The data represented training events (n = 13,525) spilt between AQP-only (n = 11,180) and AQP+VR (n = 2,345). The groups were compared in terms of cabin door training pass rates. **Results.** The observed training pass rate was 84% in the AQP group vs. 88% in the AQP+VR group. **Conclusion:** Supplemental XR training appeared to improve cabin door procedural training effectiveness, although there were some important study limitations resulting from the retrospective study design.

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Introduction

The Federal Aviation Administration (FAA) Air Carrier Training Systems and Voluntary Safety Programs Branch, AFS-280, requested this research to investigate extended reality (XR) use in flight attendant training. AFS-280 will provide air carriers and certificate management offices information on implementing XR in cabin safety training programs. AFS-280 leadership will determine whether to issue a new guidance document on extended reality in training or incorporate information into a scheduled rewrite of AC-120-54, Advanced Qualification Program (AQP).

This research sought to inform the process of accepting and certifying XR training devices and software for flight attendant job-specific tasks, procedures, or other facets. XR is an umbrella term that encompasses current and future immersive technologies. One of the XR technologies under investigation in this study was virtual reality (VR). Throughout this manuscript, the terms XR and VR will be used accordingly to reference either the broader immersive technologies or VR specifically. The overall study objective was to evaluate if those who received the AQP with supplemental VR training were more effective than those receiving the AQP training alone in demonstrating aircraft cabin door procedures proficiently.

Background

Flight attendant training under Parts 121 and 135 operations consists of five key areas that ensure the requisite knowledge and performance to serve as a flight attendant (FAA, 2022). The key training areas include training for new hires (initial new hire and equipment), new aircraft groups or types, annual recertification, and requalification after lapses in qualification period or checks. Initial new hire training covers general company information, Federal regulations, and basic aircraft-specific training such as aircraft door opening and closing procedures (FAA, 2022).

The mass quarantining associated with the 2020 global pandemic increased interest in innovative ways to meet training requirements beyond the traditional classroom. A potential solution, XR, was identified as a viable modality to maintain physical distancing while providing remote and, in some cases, group learning opportunities. Despite few airlines implementing this technology presently, interest in implementing this technology in aviation training over the next several years is likely to increase (Baghdasarin, 2020; Brown, 2017; Kaplan et al., 2021).

There is a knowledge gap regarding the effective use of XR in flight attendant training. Specifically, understanding the technology, its capabilities, and if there is a beneficial positive knowledge transfer. International regulators such as the International Civil Aviation Organization (ICAO) and the European Union Aviation Safety Agency are collaborating with the FAA to develop guidance for incorporating XR in flight attendant training programs. This collaborative project, the ICAO Ad Hoc Working Group on Cabin Crew Digital Learning, is aimed at providing information for regulators and air operators for acceptance and certification. However, this project should be supported by quantitative data.

This study analyzed existing data collected during new hire flight attendant training at one operator that used AQP and XR training methodologies to determine the potential benefits of XR technology in various training scenarios. Therefore, research was initiated to understand if AQP+XR training is more effective in achieving acceptable cabin door operations proficiency when compared to those who receive only AQP training. The hypothesis was minimum acceptable proficiency would be achieved for a higher number of training events using AQP+VR vs. AQP alone.

Methods

Research Design

This study used a retrospective cohort design applied to an existing proprietary dataset in which the unit of analysis was training event with individuals potentially contributing multiple training events. As human subjects research, this project was reviewed by the FAA Institutional Review Board and qualified for exempt status as all data was deidentified.

Dataset

The dataset was comprised of new hire AQP training results for 13,525 training events among 7,135 individuals conducted in 2019, 2021, 2022, and 2023. As these records pertain to new hire trainees, none of the individuals underwent this training in more than one of the listed years. A subset of trainees was exposed to augmented training involving programmatic lessons delivered through a head-mounted device within a specialized training environment. These VR applications simulated door operations and emergency procedures, highlighting aircraft-specific distinctions.

In 2019, trainees were both scheduled and could self-select to participate in VR training on a day off from AQP training. In subsequent years, the training schedule accommodated a time slot during class days for a subset of flight attendants to attend VR training. However, due to the increasing number of trainees and the heightened demand for training resources, the voluntary option for VR participation was discontinued until 2024.

AQP training sessions covered operations of the Boeing 737 door and over-wing window exit; Airbus 319, 320, and 321 door and emergency exit operations; Boeing 777 door and emergency exit operations; and Boeing 787 door operations. This study included only the training events aligned with the VR lessons and corresponding proficiency assessments—specifically the Boeing 737 over-wing window exit, Airbus 321 emergency exit, Boeing 777 emergency exit, and Boeing 787 door operation.

All trainees initially completed web-based training modules on aircraft specifics, including door operations and emergency procedures. Subsequently, they engaged in hands-on group practice using an aircraft cabin door training device. Some trainees were provided VR training with half of those undergoing the VR lesson before and the other half after the hands-on session. Hands-on sessions are for practice that could be completed on an aircraft or a physical cabin door mock-up. This is completed prior to demonstrating proficiency in a skills assessment. After receiving this practice, the trainee underwent an FAA-mandated proficiency assessment conducted by an instructor/evaluator. For clarity, the training and intervention order is illustrated in Figures 1, 2, and 3.

Figure 1

AQP-only Training and Proficiency Demonstration Path

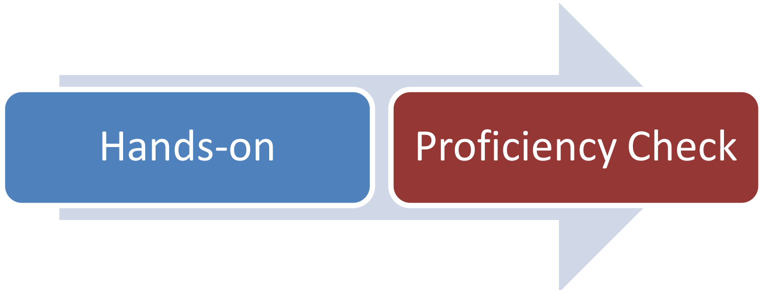


Figure 2

AQP+VR Training and Proficiency Demonstration Path One

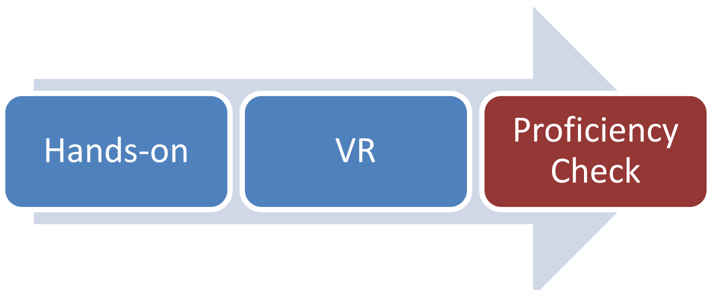
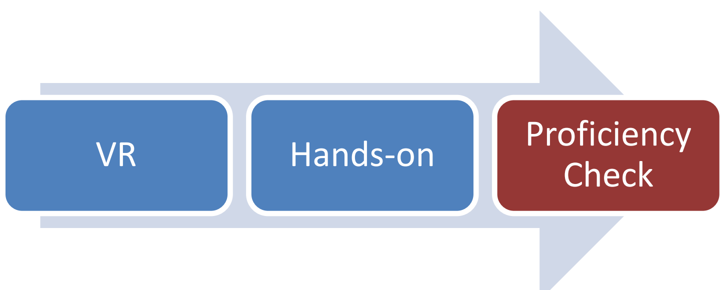


Figure 3

AQP+VR Training and Proficiency Demonstration Path Two



The dataset included proficiency ratings for individual training events without linkage to a specific trainee. The columns in the dataset were divided by each aircraft lesson (i.e., Boeing 737 over-wing window exit, Airbus 321 emergency exit, etc.) and the related proficiency check on the aircraft and exit type. The lesson column indicated the training session type: AQP or AQP+VR. The associated proficiency column indicated the ordinal score in each proficiency demonstration using the collaborating organization's methodology.

The dataset did not delineate the order in which the VR or hands-on practice occurred prior to the proficiency check. Although not testable in this study, there was no reason to believe that the order in which a candidate received supplemental training (before or after hands-on practice) would have any influence on proficiency. The variables examined in this study are further defined.

Variable Operationalization

VR Intervention – This binary independent variable categorized training events into two groups: training events including the VR intervention (AQP+VR) and training events comprising only the standard AQP training (AQP), as routinely provided by the cooperating organization.

Proficiency – This ordinal variable applies the five-point validation scale used by the cooperating organization. The scale is defined as follows: 1 (errors cannot be corrected at the current level), 2 (errors are unnoticed and uncorrected by the trainee, leading to an inadequate margin of safety), 3 (no self-correction but an adequate margin of safety is maintained), 4 (self-correction is observed, and the trainee demonstrates a good safety margin), and 5 (the trainee performs without errors). Based on the cooperating organization's cut point, proficiency was transformed from an ordinal to a binary variable, which was the dependent variable in this study. For the purposes of initial training, the organization deems proficiency scores of 3 or below as failing and scores of 4 or above as passing.

Statistical Analysis

In coding the VR intervention variable, flight attendants who underwent only AQP training were assigned a value of 0, while those who received both AQP and VR (AQP+VR) training were assigned a value of 1. Following the organization's scoring protocol, proficiency scores ranging from 1 to 3 were recoded to a value of 0, indicating failure, and scores of 4 and 5 were recoded to a value of 1, signifying passing. Data analysis was accomplished using IBM SPSS Statistics for Windows, version 28.0 (Armonk, NY: IBM Corp.).

Results

As shown in Table 1, the observed training pass rate for the AQP+VR group was higher than that of the AQP group ($X^2(1, 13525) = 24.22$, p = <.001), which supports accepting the research hypothesis.

Table 1

VR Intervention and Proficiency Crosstabulation for Training Events

Condition	*Fail (n)*	*%*	*Pass (n)*	*%*
AQP only	*1827*	*16.34*	*9353*	*83.66*
AQP+VR	*288*	*12.28*	*2057*	*87.72*

Note. AQP = Advanced Qualification Program; VR = virtual reality.

Discussion

The findings from this study revealed a significant association between XR training and demonstrated proficiency. However, it is important to recognize that the group not receiving the VR intervention also demonstrated high proficiency levels through AQP training alone. Additionally, it is unclear whether the higher pass rate in the AQP+VR training events was due to unique aspects of the VR training intervention or simply increased opportunities to practice relative to the traditional AQP training. This outcome may reflect the efficacy of the organization's training and validation processes. As such, the combination of AQP and XR training seems to be at least as effective as traditional AQP training in terms of achieving proficiency. Implementing XR in flight attendant training requires careful consideration of timing and content alignment with the intended tasks.

This study has several important limitations worth considering when assessing these outcomes and for future studies. The data analyzed were sourced from a single organization and focused on specific job tasks relevant to flight attendant training. Consequently, the findings may not be applicable or extendable to other sectors or training frameworks. A lack of demographic details in the dataset constrained certain analytical possibilities, though the sample is presumed to be reflective of the broader flight attendant workforce. It is also possible that the new hire flight attendants in the sample might have had prior experience or familiarity with aircraft door operations, potentially skewing their proficiency outcomes.

Further research is needed to address unanswered questions from this study, such as identifying the most effective type of XR for specific tasks and determining if XR contributes to long-term retention of information. Future studies should also explore the impact of the interval between training practice and proficiency demonstration. Additionally, validating the positive transfer of knowledge from XR training to actual performance is crucial for more confidently incorporating XR into flight attendant training programs.

Conclusion

This study evaluated the effectiveness of integrating XR training into the existing AQP for flight attendant training. Future research should focus on refining data collection methods to align with specific research designs, exploring the type of XR most effective for training scenarios, and the methodologies for data acquisition. Such enhancements are vital for improving research quality. Additionally, subsequent studies should investigate the transfer and retention of knowledge over time, including examining whether certain types of XR offer distinct advantages for learning specific job-related tasks.

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