EXTENDED REALITY IN FLIGHT ATTENDANT TRAINING: PERCEPTION AND ACCEPTANCE

by

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ABSTRACT

This study aimed to understand the perception of extended reality (XR) technology in flight attendant training. Comparing and contrasting current approaches to flight attendant training in the United States and XR technology yields similarities and many differences. Two common methods require flight attendants to demonstrate proficiency in several areas, such as aircraft familiarization, emergency procedures, and security procedures, to qualify as a working crew member of commercial aircraft. This study examines the views of flight attendants. The data analysis compares demographic information, technology use, and understanding of the technology. Results of the study indicated no significant effects or relationships between age or gaming experience and the influence of those variables on positive or negative perceptions and acceptance of XR in flight attendant training. Many of the participants in this study have experienced some form of XR and many have a moderate view of its implementation in flight attendant training. This moderate view could indicate some openness to try XR in flight attendant training to better understand any benefits or value it might contribute.

Keywords: extended reality, XR, flight attendant training, regulations, policy change

Copyright Page

Dedication

I dedicate my dissertation with love and appreciation to Greg, Mom, Ken, and Sharon. This dissertation is dedicated with love and appreciation to those who have returned home before the completion of this work: Eddy, Harry Lyle, Grandma, Grandpa. I love you always and forever. You all have supported me unwaveringly throughout this entire process. You have stood by me throughout the ups and downs of my entire journey. You lift me up when I doubt, you cheer me on when I am despondent, and you surround me with love and compassion when I am my toughest critic. This capstone manuscript is a representative manifestation of your support and love. Jeremiah 29:11

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I would be remiss to let this opportunity pass without thanking everyone who has supported me throughout my entire career. Although too many to name here, you have left an indelible mark on my heart.

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CHAPTER 1: INTRODUCTION TO THE STUDY

Introduction

The Federal Aviation Administration (FAA) standards and regulations mandate various aspects of the flight attendant training programs in the United States (U.S.) (Breeding et al., 2021; FAA, 1970). The FAA approves traditional and Advanced Qualification Program (AQP) approaches to flight attendant training (FAA, 2022). However, this study examines a third consideration to potentially enhancing both approaches to flight attendant training by incorporating extended reality (XR) technology.

The U.S. commercial airline industry began in the 1930s and has grown much over the past several decades. Flight attendant hiring, training policies, and practices have changed much since the early days of commercial air travel. This study proposes to examine flight attendants' perceptions of XR training when used in U.S. air carriers' FAA-approved training programs. The data collected in this study will reveal the thoughts, beliefs, experiences, and concerns of those trained by either traditional- or AQP-style programs. This chapter provides the foundational background of the airline industry and XR technology, states the problem and defines the purpose of this study, presents the research questions and hypotheses, and discusses the study's assumptions, limitations, theoretical foundations, and significance.

Background

The flight attendant profession began in the early 1930s when commercial aviation was relatively new (Kraus, 2008). In those early days, flight attendants were called stewardesses and were female nurses by trade. Over time, the profession advanced,

encompassing a broader sense of socio-demographic inclusion, job tasks, and responsibilities. This growth emphasized expanding the training curriculum, including when and how a flight attendant must react in an emergency.

Currently, the required components of emergency training include emergency assignments, procedures, and equipment used for various situations, such as ditching, land emergencies, and hijacking (FAA, 1970). Each component challenges the training environment and the instructor's ability to create an immersive environment. The instructor and environment must also contextualize the desired urgency that the student must accurately reflect. A classroom or aircraft cabin mock-up is a problematic venue to replicate an incident where specific forces or mechanical anomalies create an emergency that elicits the urgency and situational awareness a flight attendant needs to drive their actions. In a recent special report, researchers assert that inexperienced crews trained in non-immersive scenarios are the least beneficial in emergencies (Butcher et al., 2020). Technology offers an immersive environment that can replicate emergency scenarios.

Technological innovations have advanced to include reality-based concepts that supplement or substitute the natural environment. Although XR technology transports users to a new virtual environment with unparalleled levels of realism, the thought of the technology began long ago. As commonly accepted, the generic term XR is an encompassing term used herein, which includes augmented reality (AR), mixed reality (MR), and virtual reality (VR) technologies (Çöltekin et al., 2020).

Some XR components have been a product of imagination since the late 19th and early 20th centuries (Baus & Bouchard, 2014; Forrest, 2018). Baus and Bouchard (2014) note that an early idea of AR appeared in a children's fairy tale, *The Master Key*, by L.

Frank Baum. In the story, the protagonist dons a pair of spectacles that display letters on others' foreheads. The letters correspond to the individuals' characteristics, such as "N" for nice, "A" for arrogant, and "R" for rude. The fictional and present technology is similar in requiring special hardware to view informational overlays within the natural environment. Observed advancements in the various XR sub-technology are evident.

Early VR device iterations include the 1838 stereoscope, a precursor to the 1938 View-Master (Forrest, 2018). Later, as the technology grew, more components were added to include multi-sensory experiences. This growth in programming, hardware, and overall experience characteristically defines what is known as today's XR. Herein is an overview of the various XR technology versions to better understand how to achieve various learning and research goals.

Component Description

Defining XR, and its sub-components, AR, MR, and VR, can be daunting and is the subject of some debate. In some ways, each may overlap in certain functionality, requirements, or outputs, all while possessing unique characteristics that define its place within the XR genus. Further, there are aspects of AR and VR that vary. These variations are active and passive AR and conventional and immersive VR fields (Frederiksen et al., 2020).

Active and Passive Augmented Reality

Unique characteristics of AR software tend to center on the user, environment, and interaction level. AR does not require highly specialized or uncommon equipment to place a digital overlay on the natural environment; however, the interaction between the environment and the user is limited. There are two distinct versions within the AR

context: active and passive.

The primary differences between active and passive AR emanate from the user's experience. Active AR allows users to use hardware to engage with digital overlays within the natural environment. An example of active AR is when an individual uses a manufacturer or retailer's smartphone application to place a digital furniture representation to scale in the user's room. Passive AR differs by its interactivity limitations.

Passive AR is a less interactive experience, likened to watching a presentation (D. Ferguson, personal communication, April 14, 2021). An example of passive AR could be a medical student using a head-mounted display (HMD) to attend a surgical operation in another city. The user might see the patient and medical staff interacting but have limited interaction with either. Further, the student may also see digital overlays depicting the patient's vital sign information on the screen. The student may also be able to see an active chat box where other students are posting questions. However, the students cannot necessarily interact directly with surgical instruments or procedures. Both active and passive AR is unique when compared to VR.

Conventional and Immersive Virtual Reality

The key feature of VR is that it is a digital representation of a natural environment. It may also require specialized equipment such as an HMD or other hardware devices to supplement or create an entirely immersive and digital environment. Users experience these highly immersive and interactive environments, which can represent the real world or an entirely fictional one. There are two main types of VR: conventional and immersive.

Conventional VR typically involves a programmatically created environment where users can interact with the software through a computer and a monitor (Frederiksen et al., 2020; Mirelman et al., 2016). This type of VR provides a semi-realistic, not immersive, experience. An example of conventional VR could be gym equipment that depicts riding a bicycle on a country road as it matches the difficulty level using resistance on the equipment. Immersive VR differs because it can remove the user from the natural environment.

Immersive VR generally requires using an HMD and controllers to place the user in a completely fabricated environment with varying levels of interaction. This type of VR creates a new environment with multi-sensory inputs that respond to the user's behavior and actions (Comer, 2016; Frederiksen et al., 2020; Mirelman et al., 2016). An example of immersive VR might include commercially available products such as the Meta Quest device or HTC Vive, which allows users to experience multiple games and other software within its virtual application store.

Mixed Reality

The third form of XR, MR, is still a relatively new concept, and its use might deepen with time. This form of XR requires a special HMD that overlays an interactive digital component to the live environment. Although this may closely resemble active AR, the critical difference between these forms is that MR offers significant interactivity with the natural environment. Examples of MR might include a flight attendant walking along the aisle of an aircraft with the MR device detecting the presence of and projecting the real-time status of emergency equipment stowed within closed compartments.

Problem Statement

Individuals with primary responsibilities to respond to emergencies in their line of work should have practical training that prepares them for the emergencies they could experience. Although flight attendants currently attend that training, the question arises if it can be done better and more realistically without danger. Flight attendants are rarely studied (McNeely et al., 2018) on various topics, including training and using XR interventions in training. Commercial airlines based in the U.S. typically use one of two flight attendant training approaches: traditional and the Advanced Qualification Program (AQP) (FAA, 2022). Although both training approaches evaluate a flight attendant's performance in subject areas, including anomalous situations and emergencies, actual proficiency could be concerning because both rely on theoretical responses during emergencies using minimal simulation of crucial issues and concerns. Further, the current methodology to train emergency response behaviors during initial and annual training may not sufficiently prepare an individual to respond to some of the pressures or changing environments in an emergency, such as crowd control and leadership (Butcher et al., 2020).

Airlines have only begun incorporating XR flight attendant training in a few lessons. A few reasons could contribute to this slow adoption, such as the training modality needing to be accredited by the FAA, lacking or conflicting research on the efficacy of XR training, and financial cost. This study aims to understand another component vital to acceptance, the end-user's perception.

Purpose of the Study

Although only some airlines have implemented XR training technology, primarily as supplemental training, industry experts and manufacturers believe this technology will

increase within aviation training over the next several years. The International Civil Aviation Organization (ICAO) and the European Union Aviation Safety Agency (EASA) in collaboration with the FAA have begun developing guidelines to approve this technology in crewmember training. The FAA is investigating further the efficacy of the technology for this specific application.

This study aimed to understand the end user's perception of incorporating this training style in a flight attendant training program. Perception and acceptance were measured and analyzed using survey results completed by flight attendants. As this is an initial study in this area, the goal was to establish a foundation for future studies. In the future, the iterative effort aims to understand XR training to inform rule makers when considering certification standards. Specifically, this study will seek to understand the "perception and acceptance of XR" by measuring (1) if qualified flight attendants believe XR flight attendant training will improve knowledge and skill transfer, (2) if there is a relationship between age and perceived benefit of using XR flight attendant training, and (3) if there is a relationship between experience with video, computer, or smart device games and perceived benefit of using XR in flight attendant training.

Research Questions and Hypotheses

Research Questions

RQ1: Is there a relationship between a qualified flight attendant's age and their perceived benefit of using XR flight attendant training?

RQ2: Is there a relationship between a qualified flight attendant's experience with video, computer, or smart device games and their perceived benefit of using XR in flight attendant training?

Hypotheses

Hypothesis 0: H_0 ($\mu_0 = \mu_{1,2}$) There is no difference between age or experience and a qualified flight attendant's perception of XR in flight attendant training.

Hypothesis 1: H_1: ($\mu_0 < \mu_1$) Younger qualified flight attendants will have more favorable perceptions of XR in flight attendant training.

Hypothesis 2: H_2: ($\mu_0 < \mu_2$) Qualified flight attendants with more experience playing games will have more favorable perceptions of XR in flight attendant training.

Assumptions and Limitations of the Study

Due to the global pandemic, many airlines reduced staffing and ceased hiring crewmembers (Duffy, 2021; Hester, 2020). One of the most considerable challenges in this study is sourcing airlines that have implemented or plan to implement XR training in their programs. Currently, only a few airlines have used VR in flight attendant training worldwide. Only one known U.S. airline conducted flight attendant new hire training, with supplemental XR training, a few months before the wide-scale lockdowns associated with the pandemic. Several airlines are not motivated to implement this style of training because (1) it is not well understood, (2) the cost and benefits are not well understood or realized, and (3) regulations do not provide for certifying, accepting, or inspecting XR flight attendant training rather than other training approaches. Therefore, a limitation of this research may be a general lack of knowledge of the technology and its application in a flight attendant training setting.

The limitations this study encountered are consistent with those identified in other studies, including the inability to generalize the results to other roles or industries, user acceptance and sample representation of the population. Sociocultural and socioeconomic

issues are also of concern and may limit the research. On-screen guides, instructions, or other written or verbal cues may be perceived or understood differently across various regions or cultures. Although many foreign carriers use English as the primary business language, other languages may be used by those in the flight attendant role. Therefore, accounting for misunderstandings due to language barriers may limit the study's results. Familiarization and experience with advanced technologies may hinder some learning abilities and ultimately skew the results. Consistent with voluntary survey-based descriptive and correlational research, limitations include low response rate and self-reporting data accuracy.

Theoretical Foundations of the Study

The theoretical foundation of this study was rooted in cognitive processing and cognitivism. As a theory, cognitivism proposes that specific learning processes are unique to humans (Ormrod, 2016). One's learning is not an environmental product; instead, one actively controls their learning. Further, one structures their learning by linking it to other experiences, beliefs, motivations, and worldviews. Lastly, the evidence of learning is a change in one's behavior.

Social cognitive theorists disagree with this point as they assert that simply because learning has taken place, behavior does not always change (Ormrod, 2016). However, the difference between these perspectives lies primarily in latent learning, as described by Edward Tolman. In his seminal research, learning manifested in behavior vis-a-vis increased performance when adding reinforcement. This observation provides strong evidence that introducing reinforcement at the correct time during training could help improve desired behavior manifestation. Tolman believed attaining one's goals is

the primary motivation behind purposive behavior. Therefore, it is necessary to understand the basic needs and goals of the learner to motivate them to perform in the desired manner properly. However, evidence-based training is another theory that applies to the study's theoretical foundation.

AQP is a data-driven training approach that uses that data to evolve and improve over time (FAA, 2022). The hallmark characteristic of evidence-based training is using data to improve its programs (Colvin Clark, 2020). However, Colvin Clark cited a few studies examining VR and training between 2013 and 2018. Colvin Clark noted that the results were insignificant regarding post-testing and knowledge assessments; however, there were more positive experiences and levels of engagement with the learning materials. As revealed in the literature review, there are mixed results, with some studies showing significance in learning using VR and those that do not. Colvin Clark asserts that immersive environments may not promote advantages in learning but might be more effective in teaching emotional-based lessons. Future studies could benefit significantly from linking and testing specific learning theories to XR learning.

Despite this uncertainty, the three theories presented in this study, cognitivism, social cognitive theory, and evidence-based training, contribute attributes that provide a deeper context to a comprehensive XR training system. Evaluating flight attendants' perception and acceptance of XR training in three segments (1) lesson goals and presentation, (2) the learner and their experience, and (3) information retention could align well with certain aspects of the three theories.

Lesson Goals and Presentation

The lesson goals and presentation segment borrow strongly from cognitivism

because the learner assimilates training based on previous experiences, knowledge, and worldviews (Brieger et al., 2020; Clark, 2018). The goal of a cognitivist is to ease the acquisition and assimilation of training into the memory (Brieger et al., 2020). Providing lessons that help chunk information can reduce the learner's cognitive load, making transferring information into the working memory easier. Based on their company's chosen training method, flight attendants may feel that XR in a training scenario is a game that is not a tool for knowledge transfer relevant to their job tasks. Flight attendants may also perceive their experience to be more closely related to playing games rather than learning or reinforcing skills and behaviors.

The Learner and Their Experience

Social cognitive and purposive behavior theories contribute to learning by focusing on the learner and their experience in the learning environment. Further, the learner is more motivated to complete the lessons because it affects their job status. Additionally, the learner can be motivated to acquire and use information by actively participating in their learning and learning processes, allowing the instructor to act as a facilitator or mentor, as described by the heutagogy theory (Brieger et al., 2020). In XR training, motivation and engagement with the experience might achieve additional results by adding some gamification. An example of this in the programmatic scheme only allows advanced lessons or levels to be unlocked if first successful in pre-requisite areas. This unlocking of advanced levels is a proverbial toll gate and a reward system that might encourage further learning through increased participation. Flight attendants' perceptions of this achievement could resonate more with those with experience playing programmatic games.

Information Retention

Information retention is an essential component of training. Measuring knowledge retention in flight attendant training could include analyzing VR lesson successes and failures and an opportunity to evaluate the lesson or the individual's performance. Another time to measure knowledge retention is during flight attendants' annual currency training to understand lesson retention. This evidence-based training approach gives statistical power to quantitative learning measurement. However, taking a point from social cognitive theory, just because the behavior manifests in the training environment does not mean the behavior remains consistent outside of that environment. As part of the evidence-based training approach and a safety management perspective, quality assurance measures could be necessary to validate the performance of the desired behaviors in live environments. Flight attendants may credit retention to years of previous training but may fail to assign skill enhancement by practicing those skills in a new context.

Although this tripartite approach to XR training integration is one way to view it, it is not the only way. The three theories presented herein could explain or contribute to studying this technological intervention. Further, the three theories could transcend beyond their related segment of training. For example, the data from evidence-based training could validate information retention, identify improvement areas, and change lesson goals and presentation modalities.

Definition of Terms

The following is a list of definitions of terms used in this study.

Advanced Qualified Program (AQP) – The AQP is an alternative training methodology

where participating airlines demonstrate compliance through data-driven results (FAA, 2022). AQP emphasizes several vital attributes, including crew resource management techniques, increasing proficiency, and scenario-based training.

Augmented Reality (AR) – AR is a sub-element of XR that applies a digital overlay to a view of the natural environment (Brown, 2017).

Code of Federal Regulations (C.F.R.) – The U.S. C.F.R. is a collection of prescriptive standards developed, maintained, and enforced by U.S. government agencies and administrations. The organization of these standards follows a Title, Chapter, Subchapter, Part, Subpart, and Section format. Many applicable sections relevant to commercial aircraft operations are in Title 14, Chapter 1, Subchapter G, Part 121 and comprise several sections within the Part. For example, the exact section addressing crewmember emergency training is Title 14, Chapter 1, Subchapter G, Part 121, Subpart N, § 121.417, written as 14 C.F.R. 121.417.

Crew Resource Management (CRM) – CRM is a concept applied to crewmembers working together despite rank, seniority, or any other potentially influential status, which might prevent critical information from being shared or stifle teamwork (FAA, 2004).

Culture – The worldview or perspective through which one defines reality, influenced by social cues and norms (Marsella & Yamada, 2010).

Extended Reality (XR) – XR, which includes augmented reality (AR), mixed reality (MR), and virtual reality (VR) technologies (Çöltekin et al., 2020).

Federal Aviation Administration (FAA) – The FAA is a sub-agency within the U.S. Department of Transportation. The FAA is the regulatory authority that creates and enforces regulations concerning many aspects of operations within U.S. airspace. The

FAA is responsible for accepting crewmember training protocols developed by U.S. airlines (U.S. Department of Transportation, 2018).

Head-mounted Display (HMD) – A HMD is a specialized hardware unit used to display software, typically associated with extended reality (Çöltekin et al., 2020).

Mixed Reality (MR) – MR is a sub-element of XR that applies a digital overlay onto the natural world environment as if the digital objects are genuinely in the environment (Brown, 2017).

Subpart N & O Training – Typically referred to as traditional training (FAA, 2022). 14 C.F.R. Part 121 Subpart N contains the regulations prescribed for crewmember training programs. 14 C.F.R. Part 121 Subpart O contains the regulations prescribed for crewmember qualifications.

Virtual Reality (VR) – VR is a sub-element of XR that immerses an individual into a digital environment separate from the natural world (Brown, 2017).

Significance of the Study

This study is significant to several key constructs, including training theories, motivation, learning, performance, proficiency, technological application in education, and Christian translational frameworks. The results of this study are critical to advance the literature to address specific needs regarding policymaking, flight attendant training curricula, and motivation to enhance training for a knowledgeable workforce.

This advancement of these constructs and needs is essential because it attempts to understand the modern context with solid guidance from historical perspectives. Technology is on an ascending trajectory fueled by innovation, expanded resource access, and vision, which appears to have few limits or bounds. It is a necessary topic to

explore as it becomes more prolific in everyday use and application. The results of this study catalyze leveraging technology in a beneficial manner that serves both professionals and God.

Summary

Training flight attendants for emergencies is paramount to increasing awareness, safety, and human-occupant survivability in aircraft-related incidents and accidents. Current training methodologies attempt to train for the events but primarily rely on role-playing and imagination to create a sense of urgency, force in-the-moment decision-making, and commit strategy and proficiency to rote memory. However, several technological advancements now allow for more immersive, life-like emergency training scenarios that pose little risk to the learner. In these situations, the learner can become proficient by making mistakes in training with minimal costs and outcomes. Understanding the perception of XR in flight attendant training will identify those areas where XR might experience challenges with acceptance and integration in the current training environment.

CHAPTER 2: LITERATURE REVIEW

Overview

This chapter establishes a historical and philosophical approach to the subject and the technology leveraged. Presented herein is a review of the search strategy for a better understanding of the approach and a means for future replication. Next, the literature review adds context to the study, identifies research gaps, and establishes a path for future investigations. Doing so could help round out the current understanding of the state of the technology and provide potential translational approaches to other issues.

Description of Search Strategy

Literature searches for this study were conducted within several online databases using various search terms. Search databases utilized were ProQuest, Sage Journals, EBSCOhost, Heliyon, and Elsevier using the web-based Jerry Falwell Library. The relevant article search within these databases includes peer-reviewed scholarly journal articles published within the past five years. The search terms used (and number of results) were flight attendant training (2,130), extended reality (167,437), extended reality training (56,111), XR (99,656), XR training (8,822), augmented reality (47,465), augmented reality training (20,081), AR (952,528), AR training (114,866), mixed reality (150,376), mixed reality training (55,860), MR (1,054,591), MR training (145,712), virtual reality (114,182), virtual reality training (48,547), VR (154,833), VR training (26,617), flight attendant and XR or AR or VR or MR or extended reality or augmented reality or virtual reality or mixed reality and training (895), and competency-based learning and nursing education (43,277).

The inclusion criteria for the literature review included (1) relevant publications

that present findings on using XR technology in training, (2) publications that provide rich history or background information on the subject, (3) publications that identify transferable skills in disparate industries using XR training, (4) publications written in English, and (5) publications that address competency-based training in nursing. Much of the published research is within the past five years; some contextual or seminal publications extend beyond five years.

Articles in the same databases provided background articles concerning the historical perspective and information about the flight attendant profession; however, this search was neither restricted to publication date nor peer-reviewed scholarly journal articles. The terms used in this search (and number of results) were flight attendant (629,285) and flight attendant history (35,740).

Biblical research for this study used the Alta Religion Database with AtlaSerials Plus, ProQuest, and the Religion and Philosophy Collection databases accessed through the Jerry Falwell Library. The inclusion criteria for the search specified the scholarly articles (1) used English as a primary language, (2) had a keen Christian focus, (3) provided full text available online, (4) addressed a Christian view on XR or related technology, and (5) were peer reviewed.

Provided herein are the relevant database, terms used, and results. In the Alta Religion Database with AtlaSerials Plus, the search terms (and number of results) were proficiency and performance (85), proficiency (85), training (19,923), helping others (217), and Christian values and workplace (2). Using the ProQuest Religious Database, the search terms (and number of results) were proficiency and performance (85). The Alta Religion and Religion and Philosophy Collection, common search terms, were

extended reality (4), virtual reality or VR (97), augmented reality or AR (1,598), and mixed reality or MR (1,844).

Review of Literature

This study examined philosophical approaches, several learning theories, and perspectives on learning to structure the framework. A paradigmatic shift required reevaluating XR's evolving nature, environment, and relationship with reality. Theories on learning and memory are offered for investigation, bolstering this study's constructs. Finally, perspectives on the airline industry and its relevant roles gave the context to the present study.

Defining Reality and Extended Reality

A widely accepted and often referenced model of the relationship between reality and XR is the continuum proposed by Milgram and Colquhoun, as seen in Figure 1 (Valente et al., 2018). The primary issue with this model is that the relationship between reality and XR exists on the same continuum without regard to philosophical arguments, cognitive processing, and knowledge transfer. Therefore, to investigate these environments, one first must separate them, as seen in Figure 2.

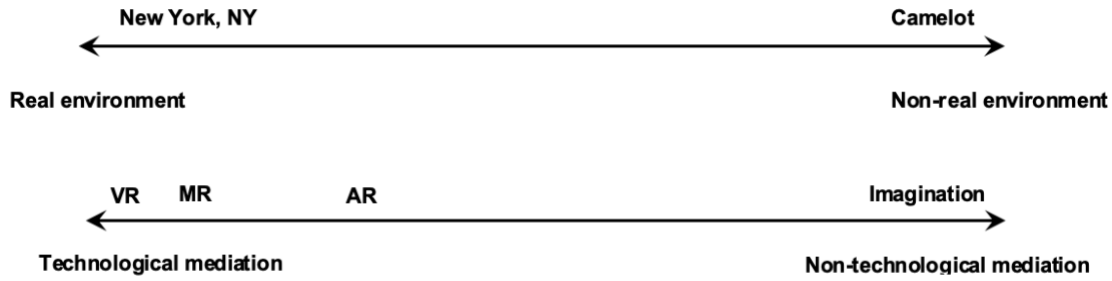
Figure 1

Milgram and Colquhoun's Continuum of Real and Virtual Environments

Note. As Milgram and Colquhoun developed, this continuum model depicts the real and virtual environments at opposing ends (Valente et al., 2018). This model is contentious because it depicts the relationship between technology and the environment.

Figure 2

The Proposed Continua of Reality and Technological Mediation



Note. Top: A proposed version of the reality continuum distinguishes true opposites using an actual and fictional city to demonstrate philosophical logic. Bottom: A proposed version of the technological mediation continuum represents how AR, VR, and MR genuinely affect the environment instead of actual cognitive functioning, such as one's imagination.

To challenge this perspective, one must employ philosophical logic using the laws of noncontradiction, excluded middle, and identity. These three laws highlight the fallacy of placing natural and virtual environments on the same continuum. First, the law of noncontradiction says that two objects cannot be and not be simultaneously in the same way (Foreman, 2014). Therefore, the natural environment cannot be absolute and virtual simultaneously in the same way, which is how one experiences both. The opposite of a natural environment is anything but a real environment, not a virtual one. The law of excluded middle asserts that something is either wholly or not; there is no in-between (Foreman, 2014). Therefore, a natural and non-real environment is precisely that; a virtual environment using technological mediation exists independently despite the two overlapping or interacting. Lastly, the law of identity says an object is what it is (Foreman, 2014). In this context, a natural and a virtual environment, in varying degrees, are simply and precisely what each is. Although the environments may interact at the same time and place, the two environments are never wholly integrated with existing on

the same continuum.

Perhaps another way of considering this fracture is to consider the creator of reality. The ultimate creator of actual reality is God (*English Standard Version*, 2001, Genesis 1:1-31); however, the creator of virtual environments is heavily influenced and controlled by humans. One may argue that God created virtual environments, and even further, humans interact with actual reality and influence those environments because of God's gift of free will. These are valid points, but a fundamental idea becomes overlooked. The digital creator develops a world with finite boundaries and confines within a scoped experience. This digital creator also narrates the story they want the user to experience. In turn, the user defines the experience for themselves, heavily contextualized by the digital world created for them.

In actual Creation, God provides some limits and boundaries, but humans cannot alter the course of Creation. One might argue that humans have already altered the course of Creation through various consequences of their actions, such as the industrial revolution's impact on the climate. However, humans have influenced the environment in which they live, but the ultimate destiny of Creation is God's will (*English Standard Version*, 2001, Matthew 6:10). God is the ultimate controller and sole influencer in changing His Creation. Next, to provide foundational knowledge, an examination of the U.S. airline industry and its approaches to training throughout time is offered.

Historical Perspective of the Airline Industry

Historians have traced the roots of the modern airline industry back as early as 1926. Present-day American Airlines began with some of the first U.S. mail shipments flown from Chicago to St. Louis, piloted by Charles Lindbergh (Kraus, 2008). In 1927,

three more airlines began their routes in what would later become Pan American Airways, United Airlines, and Eastern Airlines. In 1929, the early beginnings of Trans World Airlines (TWA) closed the decade of commercial air travel. In those times, pilots were responsible for all aspects of flight, including passenger safety briefings and comfort.

In 1926, the Air Commerce Act became law, formalizing the U.S. government's oversight of the national airspace and those operating within that airspace (Kraus, 2008). The first leader of the Aeronautics Branch, William P. McCracken, Jr., primarily focused on safety, aircraft certification, and pilot certification. Specifically, pilot certification involved training aviators in the safest manner possible. Around that time, a new training device was being developed (De Angelo, 2000). This device would address the safety concerns and fundamentally change the entire approach to pilot training.

Historical Approaches to Simulator Training

Worldwide, simulators provided decades of training for pilots. The first flight simulator used for this type of training was developed in 1929 by Edward Link, called the Link Flight Trainer (De Angelo, 2000). Although not a success initially, by 1934, airlines and the U.S. military realized the value of the simulator and began using the device to certify pilots. The device's design promoted learning to fly using instruments while receiving tactile and relative-motion feedback that mimics actual flying. De Angelo notes that over 500,000 pilots used the Link Trainer for training during World War II, which provided a safer alternative to flight training and reduced the time it took to train a pilot. The Link Trainer is one of the earliest examples of an XR device and one of the first XR devices used in crew member training.

Historical Perspective of the Flight Attendant Profession

Although many air travelers today will likely encounter at least one flight attendant on their commercial flight, few may know that this profession has spanned over 90 years. In the early days of air travel, only female nurses were eligible to be qualified to fly as stewardesses (Smithsonian, n.d.). In 1930, an Iowa nurse, Ellen Church, approached a Boeing Air Transport employee with the idea that female nurses onboard commercial aircraft would soothe nervous—and sometimes ill—passengers. It was this idea that began the profession as it is known today.

During Ellen Church's service, she developed the original training program for the stewardesses who came after her, known as the Original Eight. This cadre flew for Boeing Air Transport, which would later become United Airlines (Smithsonian, n.d.). In 1934, nurse and educator Jean Harman led the cadre of nurses who became the first TWA stewardesses (Cochrane & Ramirez, 2021). The significance of this new in-cabin role caught on as quickly as the legacy air carriers understood the significance of this role. The stewardess became crucial as the industry transferred specific cabin responsibilities from the copilot, allowing both pilots to remain on the flight deck.

Over the next several decades, the responsibilities and tasks continued evolving to meet a growing industry's demands. Hiring and marketing practices were one aspect of the industry that stubbornly resisted change. Stewardesses were required to meet a strict list of requirements, which produced an entirely homogenous profession of Caucasian females. Those who were ethnically, racially, and culturally different were disallowed to serve as a stewardess (Smithsonian, n.d.). Other draconian rules that plagued the industry included strict parameters around weight, height, age, and marital status. At that time,

these rules were in place because the industry leaders at the time created a narrative that women fitting these requirements were more attractive and, therefore, would increase revenue. In the 1960s and 1970s, these clearly discriminatory issues became more apparent. The Civil Rights Act of 1964 helped challenge the widespread inequity within the airline industry, which resulted in crucial and necessary changes to these abhorrent practices.

Keeping with the social and cultural changes, airlines began changing hiring practices to include those in minority groups, men, and others once marginalized by biased and discriminatory policies (Smithsonian, n.d.). Workplace laws in the 1960s and 1970s also focused on using humans as a marketing tool, and critical legislature inspired the job title shift from stewardess to flight attendant because the latter is more inclusive and gender neutral. By the early 1990s, society and industry grew more equitable and inclusive, recognizing that those qualified for the job did not come from just one gender, race, or national origin. Yet, there is still work to be done in these areas of inequality.

Much has changed over nine decades, but one constant has remained, the need for proper training. In Ellen Church's time, the role of a stewardess was merely a suggestion. In today's commercial air travel, flight attendants must be trained to specific standards and are part of the required crew onboard commercial aircraft.

Current Flight Attendant Training Methodologies

In the United States, the Federal Aviation Administration (FAA) mandates flight attendant training (Breeding et al., 2021). Although these regulations stipulate the minimum training, airlines typically strive to exceed those requirements. For flight attendants, the FAA accepts two methodologies of training. Title 14 of the Code of

Federal Regulations, Part 121, Subparts N and O (commonly called traditional training) stipulates flight attendant training and qualification requirements. Airlines could use various approaches to disseminate the required information in traditional training within various settings. However, this approach to training is very restrictive and does not allow for many variations (FAA, 2022).

The approved alternative to this traditional approach is the Advanced Qualification Program (AQP), which focuses on training flight attendants to be proficient, incorporating crew teamwork, and learning by doing (FAA, 2022). AQP uses a data-based approach to effect a more flexible and scenario-based training focusing on the individual and their proficiency. Airlines must demonstrate how their AQP meets or exceeds traditional training results. The effectiveness of the AQP has been recognized in pilot training for several years and continues to be the primary approach to such specialized training. Although the theory behind the AQP methodology is favorable to many, only six of the approximately 71 U.S. Part 121 airlines have implemented this training style for flight attendants (Breeding et al., 2021; FAA, 2022).

Flight attendant training typically covers significant knowledge, including aircraft familiarization, security, safety, service, basic medical, standard operating procedures, emergency procedures, and company policies and procedures. Instruction on these topics can range in formats, including traditional classroom environments, computer-based training, cabin environment simulators, or the operator's actual aircraft. The FAA must approve and certify each regardless of the setting or device. However, specific lessons or topics within this training possess a potential for injury or harm in training.

Safety, security, medical, emergency, and even standard operating procedures

training typically involves some level of danger. It is unethical to place any person in a situation where they may be injured or killed when learning such dangerous procedures, which is why every organization involved strives to reduce as much potential for injury as possible. For example, dangerous procedures flight attendant training might include reacting to a hijacking using improvised weapons, evacuating an aircraft while it is burning, or even recognizing the signs of a pressurized aircraft cabin before opening a cabin door. These examples could result in a real emergency, serious injury, or death if done in an authentic setting. In the traditional training approach, lessons on these topics might include a demonstration or computer-based training elements. AQP might use similar approaches but is flexible enough to incorporate interactive scenarios using classmates or instructors as actors (FAA, 2022).

However, despite either methodology, the flight attendant trainee is never entirely immersed in an environment that elicits raw behavioral responses safely. It is necessary to manifest these raw behavioral responses to understand how to emphasize learning new and more desirable responses (Miltenberger, 2015). Traditional or AQP training may not necessarily draw out these behaviors, which is a disservice to the individual, the airline company, and the flying public. Imagine, for a moment, an aircraft emergency landing that subsequently results in an evacuation. If the flight attendant only received training that used classmates as passengers, the level of panic and confusion would be challenging to replicate accurately within that environment without the same motivation or urgency to escape. Therefore, investigating the original occupational roots of the flight attendant role could provide insight into the effectiveness of such advanced solutions in training.

Nursing and Flight Attendant Occupations

There are similarities between the nursing and flight attendant occupations. Although not entirely identical, regulations shape both occupations, require similar skills, and perform some similar job functions. This comparison is a natural extension considering the modern-day flight attendant role began with nurses serving in this capacity. Although the technicality of both positions may differ, aviation and the medical fields share the benefits of understanding procedural practices, communication skills, and the need for precision.

Evidence of this learning exchange between fields includes incorporating crew resource management (CRM) skills between doctors and nurses (Moffatt-Bruce et al., 2017). CRM began in aviation due to research into managing risk, workload, and straightforward communication transcending rank, experience, or role for safety (FAA TV, 2012). Borrowing from the lessons learned in implementing XR training in nursing and medical education, studies have shown increased motivation to self-practice (Kim et al., 2021); positive experience and feedback using VR training (Korzeniowski et al., 2018); increased competency (Sattar et al., 2019); benefit for remote access (Singh et al., 2020); and increased longitudinal information retention (Umoren et al., 2021). Therefore, it is helpful that a closely related job role is leveraging technology with significant results. Borrowing from those findings, first understanding the perception to incorporate such training, then testing XR in flight attendant training is a logical next step.

Flight Attendant Extended Reality Training

The benefits of XR training for dangerous situations and emergencies are a primary motivator for implementing the technology into flight attendant training. One of the many critical aspects of a flight attendant's job is to command an expeditious aircraft

evacuation to increase the chances of survival and to use good CRM techniques to improve safety onboard (Antoniadou et al., 2018; Beben et al., 2020; Bennett, 2019; Liu & Deng, 2021; Melis et al., 2020; Nogues & Tremblay, 2019; Rowson & Gonzalez-White, 2019; Van Den Berg et al., 2020; Weed et al., 2018; Yang, 2020; Yelgin & Ergun, 2021). Despite the significant decrease in fatal commercial aviation accidents (Ekman & Debacker, 2018; Kharoufah et al., 2018), training crewmembers in a pseudo-realistic manner has several advantages over traditional theory- and constructed scenario-based training. There are essential conclusions from other evacuation studies, including those conducted on egress motivation and patterns from buildings during natural disasters (Ao et al., 2020). These conclusions include motivation to evacuate depending on the level of safety one feels in their current environment (Ao et al., 2020). Training flight attendants using XR to conduct evacuations and other emergency procedures can emphasize the urgency and attention needed to get passengers out of the aircraft. Further, including the conclusions from those other evacuation studies could better equip flight attendants to address panicked or indecisive passengers to get to safety.

Organizations that have implemented XR components in training or other applications have found many benefits to using this solution because it saves resources (Doolani et al., 2020), increases engagement (De Crescenzio et al., 2021; Jiang et al., 2021), and adds flexibility to training (Zhang et al., 2020). XR is efficacious in medical (Allgaier et al., 2022; Beeman & Orduna, 2018; Cano Porras et al., 2018; Garcia Fierros et al., 2021; Hood et al., 2021; Sanchez-Herrera-Baeza et al., 2020; Vaughan & Gabrys, 2020); and psychological training (Adsit, 2008; Riches et al., 2020). Also, XR can enhance information retention and emergency response behaviors (Beben et al., 2021;

Breeding et al., 2021; Buttussi & Chittaro, 2018; Chittaro et al., 2018; Nykänen et al., 2020; Pedram et al., 2021). Despite this subject being under-investigated (Kim et al., 2019; Safi et al., 2019), the more significant issue is to make an implementation decision without understanding the most practical application or use in a particular lesson. More incredible still is not leveraging the technology to prepare crew members better when facing an emergency.

Other studies have shown that engagement, knowledge acquisition, and information retention are better in XR conditions than in traditional teaching methodologies (Ke & Xu, 2020; Liou et al., 2017; Macchiarella, 2005; Rolando et al., 2018). Despite some academic resistance, organizations are increasingly implementing the technology because of the benefits XR offers as well as its resource savings, engagement, and flexibility (De Crescenzio et al., 2021; Doolani et al., 2020; Jiang et al., 2021; Pedram et al., 2021; Puig et al., 2019; Tang et al., 2021; Yung & Khoo-Lattimore, 2019; Zhang et al., 2020). Younger generational cohorts also believe that learning these new technologies will help them advance as more companies turn to these tools for training and job task completion (Bucea Manea Țoniș et al., 2020). Specific industries benefit the most from XR training.

There are several studies on XR training across various jobs and industries. In a recent meta-analysis examining XR training and its effect, researchers concluded that performance is very similar between those receiving traditional training and XR training, the effectiveness of XR training is reliant upon both the population and task, and factors that promote learning via XR are still undeterminable (Kaplan et al., 2021). The implementation of XR training for jobs that may include some response to dangerous or

unsafe conditions may be the most advantageous compared to traditional methodologies (Beben et al., 2021; Breeding et al., 2021; Buttussi & Chittaro, 2018; Chittaro et al., 2018; Nykänen et al., 2020; Pedram et al., 2021). Aerospace, for example, has used large-scale VR training for several decades to train pilots in aircraft simulators (Lekea et al., 2021), and the medical and psychological fields have incorporated XR training and communication in many aspects of training, telemedicine, and patient rehabilitation (Adsit, 2008; Allgaier et al., 2022; Beeman & Orduna, 2018; Cano Porras et al., 2018; Garcia Fierros et al., 2021; Hood et al., 2021; Kim et al., 2021; Korzeniowski et al., 2018; Lee et al., 2021; Riches et al., 2020; Sanchez-Herrera-Baeza et al., 2020; Sattar et al., 2019; Singh et al., 2020; Su Yin et al., 2021; Umoren et al., 2021; Vaughan & Gabrys, 2020; Wang et al., 2018; Yu et al., 2020).

There are many variables to consider when evaluating the efficacy of XR training in any domain or job task. More studies show a positive effect in the XR training condition compared to those that do not. However, the research and technology are still far too new and incomplete to draw such rigid and definitive decisions. Nevertheless, one key issue remains, understanding how the technology might benefit or improve performance in the specific job tasks of a flight attendant.

Although the aerospace sector has used some forms of XR in training, other areas remain unexplored (Kim et al., 2019; Safi et al., 2019). Flight attendant training is no exception to this under-investigated concept. Studies of the profession tend to focus on the mental and physical stresses of the job, customer service, core competencies, and the effects of flight schedules (Bremer & Maertens, 2021). However, only a few have evaluated aspects of flight attendant training. A possible reason these evaluations are

under investigated is that airline training data is proprietary and largely stays between the airline and its regulatory authority.

Biblical Foundations of the Study

Despite many constructs under examination in this study, culture was the primary construct of concern. Culture can change over time with societal norms—the culture shift changes as values, perspectives, and attitudes toward social constructs change. Culture as a meta-scheme describes the gestalt of modern society and its reverence, or lack thereof, that sets the acceptance stage of XR technology in specific domains such as professional training. In a biblical sense, culture describes not only the zeitgeist (Caner, 2008) and gestalt of modern Christianism but also the amalgam of seeking God in unsuspected spaces. Applying the Bible to contemporary issues requires spiritual insight, prayer, critical thinking, guidance, and the most significant of these, reframing. In truth, reframing should be approached with caution because it could present an opportunity to serve a skewed perspective. Instead, one must exercise extreme diligence and prudence when reframing. Reframing in a Christian-focused manner intends to understand multiple points of view, not to pigeonhole myopic beliefs.

A verse from Romans is offered for consideration to illustrate various perspectives on culture: “Do not be conformed to this world, but be transformed by the renewal of your mind, that by testing you may discern what is the will of God, what is good and acceptable and perfect” (*English Standard Version*, 2001, Romans 12:2). In the context of the original intent, the apostle Paul addresses the citizens of Rome. Rome was the pivotal city in which Paul addressed believers as a precipice to gain the favor of the church to drive his message further into the region (Hindson & Towns, 2013). However,

there is debate regarding the context of this verse from multiple perspectives on its meaning.

The editors of a study Bible assert that this verse advises modern Christians that they are not to partake in a majority of "worldly behavior" (Tyndale, 2007, p. 1916). Therefore, Christians who rely heavily on consuming these myopic perspectives to formulate their impressions are not fully exercising their ability to think critically. An example of this potential misapplication is when churches protest artistic expressions in various media that they deem are antitheses to God (Caner, 2008). That material certainly exists; however, categorically protesting materials simply because one does not search for God, or a point to discuss God, is the beholder's issue. Caner distinguishes between the authoritarian and one who discerns with a Christian gaze. For example, if told not to engage in XR, one may become curious and fail to recognize something abhorrent. However, by teaching one why something is abhorrent to God, one can identify it in any environment or media.

Caner (2008) notes that current apologetic trends recognize Jesus as the sole source of truth and culture. When a church protests material culture, this irreverence leaves a perplexing issue at hand because they also accept the risk of protesting something inspired by God or neglecting to recognize how God indwells in these various mediums. The apostle Paul epitomizes how to find God in culture in Acts 17:17-34 when he leverages the contemporary Greek poets to discuss God (Caner, 2008). Further, culture varies across regions, and other cultures may not agree with what one society views as acceptable (Aronson et al., 2016).

Rather than subscribing to these extreme and despotic views, perhaps the Romans

verse in the modern context might mean something different. Reframing the verse, one might understand how Christians are encouraged to step aside from the temptation to consume pre-digested skewed information and seek God throughout all corners of Creation. After all, secularity could be what the beholder defines, not that God fails to exist in all Creation, including virtual environments (Bolger, 2021).

In a similar notion, in John 4:1-26, Jesus encounters a Samarian woman. Cultural practices in those times forbade a Jew to interact with Samarians, yet Jesus did. Jesus set an example that cultural practices must approach with actual Christian values, especially those that do not conform with the world in this regard. The prevailing thread that connects Jesus' actions with culture and, subsequently, XR in professional training is acceptance. Openness to exploring XR as a potentially viable training tool requires an accessible mind with a robust Christian gaze. The intent to understand this medium in training is motivated by a desire to prepare frontline responders better, fostering increased safety for the flying public.

Summary

This chapter explored the historical and foundational perspectives that shaped this study. The research helped to inform the current use of XR in professional training and a culture and acceptance protocol for incorporating such technology in training using a biblical perspective. The airline industry has a long history of providing safe air travel to millions of people. As the FAA mandates, the approved training programs ensure that competent professionals serve in crewmember roles. This training provides the foundational knowledge to accomplish the essential job skills of the flight attendant role and the skills required during emergencies. Other opportunities might exist beyond the

traditional approaches to training for specific job tasks and emergencies by immersing the trainee in a life-like scenario. This study aimed to advance the literature on XR technology and its application by first understanding how culture might influence perception and acceptance related to flight attendant performance and proficiency in performing job tasks in training.

CHAPTER 3: RESEARCH METHOD

Overview

This chapter lays the framework for the study protocol. First, the research questions and hypotheses are identified, followed by the study's design, and next, a description of the participant criteria and study procedures. Then, the chapter closes with an explanation of the measurement instruments, variable operationalization, and data analyses, as well as the assumptions and limitations of the study.

Research Questions and Hypotheses

Research Questions

RQ1: Is there a relationship between a qualified flight attendant's age and their perceived benefit of using XR flight attendant training?

RQ2: Is there a relationship between a qualified flight attendant's experience with video, computer, or smart device games and their perceived benefit of using XR in flight attendant training?

Hypotheses

Hypothesis 0: H_0 ($\mu_0 = \mu_{1,2}$) There is no difference between age or experience and a qualified flight attendant's perception of XR in flight attendant training.

Hypothesis 1: H_1: ($\mu_0 < \mu_1$) Younger qualified flight attendants will have more favorable perceptions of XR in flight attendant training.

Hypothesis 2: H_2: ($\mu_0 < \mu_2$) Qualified flight attendants with more experience playing games will have more favorable perceptions of XR in flight attendant training.

Research Design

The research design of this study was both a descriptive and correlational survey-

based study. The study relied on survey responses from qualified flight attendants self-reporting their demographic information and recording their perception of XR in flight attendant training. The survey asked the participants to quantify their level of experience with gaming to understand if this construct affects positive or negative perspectives regarding technological intervention. Analyses revealed if there is any correlation between age and their perspective on incorporating XR into flight attendant training, be it optimistic or pessimistic.

Ethical and practical considerations form the approach to this study. A survey allows for a genuinely non-identifiable data collection methodology that protects participants' identities. Even when compared to an interview or focus group, a survey is the best approach to capture the data needed for this study and likely provides the best environment to receive more accurate answers. As for perception, it would be impossible and impractical to observe one's outlook on the future and to truly capture their beliefs and thoughts about the future of this technology when used in this novel training environment. The approach to data collection and the data collected from the survey will fulfill the purpose of this study by providing a quantitative measurement of the critical components researched.

Participants

The participants in this study included those who are currently qualified as flight attendants. The term "qualified flight attendants" does not imply that these individuals typically work in that capacity. Many flight attendant managers and training staff are qualified flight attendants who may not necessarily actively work on commercial aircraft each week or month; however, they maintain their proficiency and meet the regulatory

requirements to serve as a working crewmember at any time. The demographic section of the survey included questions to understand the sample and the various participant roles. Other typical U.S. flight attendant demographics were already vetted by the company's hiring practices for employment candidacy including specific physical and educational requisites as well as one's ability and willingness to relocate to another city within the airline's network. Therefore, the candidates must possess at least a high school diploma or GED equivalent, the ability to speak clearly and effectively, and generally be 20 years or older. Other requirements include holding official immigration documents such as passports and visas, and the ability to legally work in the U.S. Candidates must attend several weeks of unpaid training and, once qualified, be on call whenever needed for flying assignments. Other detailed demographic information, such as age, has been included as part of the survey.

Gender information was not collected in this survey for several reasons related to the low value it brings to this study. Gender assignment and identity are separate matters that would confound any deduction made about the data. Further, the flight attendant occupation in the U.S. began as a role predominantly associated with females for approximately four or more decades (FAA, n.d.). There is a lack of reliable sources that report the current demographics of the profession, making it difficult to make any assertions about those demographics and their impact on this study.

In a recent study, researchers noted that gaming is primarily a male interest (Schelfhout et al., 2019), and this study examines self-reported time spent gaming, which would yield other confounding results if incorporating a gender measurement. Lastly, using an applied psychology approach, gender in this matter, assessing flight attendant

perception and acceptance of XR training, bears no relevance or value because regardless of gender, flight attendants must be trained according to an FAA-accepted program. Therefore, gender was determined to not be a valuable factor or variable that should be collected in this study.

Study Procedures

The airline representatives received a description of the research, instructions for the survey, and the survey for distribution. Airline representatives distributed the surveys via email to several flight attendants. The airline contacts assisted by emailing the recruitment email (see Appendix A) to several flight attendants. A copy of the consent form (see Appendix B) was provided with the information to complete an online survey (see Appendix C) consisting of 10 XR perception questions and 10 other questions covering demographics, screening, and exposure to XR. This survey was composed and analyzed using the online survey tool SurveyMonkey.

The airline representatives provided the researcher with approximate total number of survey distributions allowing for a response rate metric. Respondents had 69 days to complete the survey between June 19, 2023 and August 26, 2023. During that period, four reminder emails were sent to the airline representatives updating them with the total number of respondents and the minimum threshold needed.

Five U.S. airlines were asked to participate in the study. The airlines and number of reported distributions were Alaska Airlines (35), American Airlines (180), Delta Airlines (15), United Airlines (24), and Southwest Airlines (190). Total known distribution was 444 individuals, resulting in a 15.31% response rate with 68 responses.

Instrumentation and Measurement

The sample group received a link to an online survey to record their anonymous responses. Participants were given access to the study explanation, instructions, and survey through the assistance of contacts who work at various airline training and operations departments. Questions focused on demographics, experience with electronic-style games, and perception. Questions in the first section related to the participant's perception of XR technology in flight attendant training. These questions used a five-point Likert scale to record the participant's responses. The questions asked the participant to reflect on their most recent training event where they had to demonstrate specific job tasks and if they believed XR would be more beneficial in those situations versus their current training experience. Then, in the second section, participants answered 10 questions related to demographics, qualification screening, and general experience with technology and XR technology.

Equipment used in this study included a password-secured computer with an internet connection to create and distribute the survey, G*Power (Faul et al., 2007) to calculate the sample size, and IBM Statistical Package for Social Sciences (SPSS) version 29 (IBM Corp., 2022) to perform the statistical analyses. The password-protected computer was kept within the researcher's control and stored in a locked and secured location. Data were converted from the online survey tool to IBM SPSS for analysis.

Operationalization of Variables

Age – This ratio variable asked participants to self-report their age at the survey completion. This variable was used to understand if there is a relationship between perception of the XR training integration and age.

Experience – This ordinal variable asked participants to rate their experience playing

games on a video game console, computer, or smart device. The questions allowed selections between “a” (I do not spend any time playing these kinds of games) to “e” (I spend about five hours or more per day). The lower selection indicated inexperience, and the higher selection indicated more experience.

Perception – Ten questions measuring perception were summed to create a total score. Each question had five possible responses with assigned values from 1 (strongly disagree) to 5 (strongly agree). The total number of each answer produced a final score representing perception level. Lower summed scores indicated pessimism, and higher scores indicated optimism.

Data Analysis

After data collection on the online web-based collector, data was extracted into a single data set. Certain questions required nominal data transformation into binary representatives for analysis, which was conducted in SPSS. A one-tailed a priori power analysis was conducted to ascertain the sample size (n = 67) needed to achieve the desired power level (β = 0.8, α = .05) to reduce the chances of accepting a false null hypothesis. Based on the limited data available (Çöltekin et al., 2020; Sagnier et al., 2020; Wang et al., 2016), a medium effect size of 0.3 was determined as a semi-conservative estimate based on the dearth of convention in prior research for this application of the population and technology.

An exploratory factor analysis (EFA) was conducted with the responses given to the first 10 questions relating to perception and acceptance. Then, a Pearson’s correlation test and ANOVA statistic to determine any potential relationships between demographics and perception or gameplay and perception. This analysis was critical to understanding

whether age or experience related to a more positive or negative perception and acceptance. Once the survey collection period ended, the results of the surveys were transcribed into the SPSS program for analysis.

Delimitations, Assumptions, and Limitations

The study's delimitations included only measuring qualified flight attendants' perceptions. This specific job and industry comprise very little of the extant literature. Therefore, the results of this study were not generalizable to other regions or industries. Gender was not examined in this study.

The assumption of study participants included their maintaining flight attendant qualification at the time of the survey, and their answers accurately reflected their beliefs. Other assumptions of this study were the participant's ability to understand the necessary skills and were motivated, or are at least open, to learn using new approaches and technology. Another assumption of this study was that the participants who responded to the survey represented the population. Lastly, an assumption was that age does not necessarily indicate time in service. Therefore, age may have been more strongly associated with perception rather than the length of service.

A significant limitation of this study was the limited experience and use of XR in flight attendant training. A general lack of familiarization or experience with advanced technologies could have inspired a negative perspective on integrating technology in training. Lastly, although English is the primary business language, some flight attendants speak other languages, or English may not have been their birth language. This socio-linguistic confounding variable could have caused some misinterpretation of the survey questions. The study strived to reduce confusing terms and eliminate

colloquialisms to mitigate these errors.

Summary

This chapter laid out the approach and method to the research design through participant selection and qualification, an explanation of the data and analyses, and the assumptions and limitations of the study. This study was the initial step in understanding the perception of new technology in flight attendant training. The results of this study provide direction for future studies and could help identify gaps or other areas for further examination.

CHAPTER 4: RESULTS

Overview

This study aimed to understand the end user's perception of incorporating an XR training style in a flight attendant training program. Perception was measured and analyzed using surveys distributed to flight attendants. Because this is an initial study in this area, the goal was to establish a foundation for future studies. In the future, the iterative effort aims to understand XR training to inform rule makers when considering certification standards. Specifically, this study sought to understand the perception of XR by measuring (1) if qualified flight attendants believed XR flight attendant training would improve knowledge and skill transfer; (2) if there was a relationship between age and perceived benefit of using XR flight attendant training; and (3) if there was a relationship between experience with video, computer, or smart device games and perceived benefit of using XR in flight attendant training.

Study recruits were contacted by airline representatives within several U.S. airlines. Recruits were asked to respond to the questions presented in an online survey. Data were collected from the recruits via an online survey using the SurveyMonkey web-based collection platform. Responses were exported from the web-based collection application into Microsoft Excel and then prepared for analysis in SPSS.

This chapter presents the data analysis results for each research question. The research questions and associated hypotheses are provided herein.

Research Questions

RQ1: Is there a relationship between a qualified flight attendant's age and their perceived benefit of using XR flight attendant training?

RQ2: Is there a relationship between a qualified flight attendant's experience with video, computer, or smart device games and their perceived benefit of using XR in flight attendant training?

Hypotheses

Hypothesis 0: H_0 ($\mu_0 = \mu_{1,2}$) There is no difference between age or experience and a qualified flight attendant's perception of XR in flight attendant training.

Hypothesis 1: H_1: ($\mu_0 < \mu_1$) Younger qualified flight attendants will have more favorable perceptions of XR in flight attendant training.

Hypothesis 2: H_2: ($\mu_0 < \mu_2$) Qualified flight attendants with more experience playing games will have more favorable perceptions of XR in flight attendant training.

Statistical data including demographic information, descriptive statistics, and the relevant analyses are presented here in a format that reports the descriptive results, then the study findings. Finally, the data and findings are summarized in the chapter summary.

Descriptive Results

An online survey was distributed to airline contacts representing five U.S. airlines. These contacts then forwarded the informed consent document along with the recruitment letter to qualified flight attendants at their airline. In total, approximately 444 flight attendants received the invitation to participate from those airline representatives. Out of the total invitations, 68 (15.31%) flight attendants completed the online survey. Demographic data were collected regarding the participant's age, qualification as a flight attendant, current work status, and most recent trip where the individual served as a working crewmember on a revenue flight. A power analysis was conducted using G*Power software, which indicated a minimum of 67 responses was required for

acceptable statistical power and higher probability of avoiding Type II errors.

Demographic characteristics regarding this population revealed a diverse sample of the population. Age of the participants ranged from 24 to 69 years (M = 48.22, SD = 11.58). All the participants (n = 68) self-identified as being qualified flight attendants and most of those are line flight attendants (67.6%) and not currently a flight attendant manager, on special assignment, or an evaluator/instructor/trainer (32.4%). This last characteristic of the sample is important because those who were in the latter category may have had more of an opportunity to be exposed to new and novel training approaches or ideas because they are considered subject matter experts, approvers, or influential decision makers for their organization.

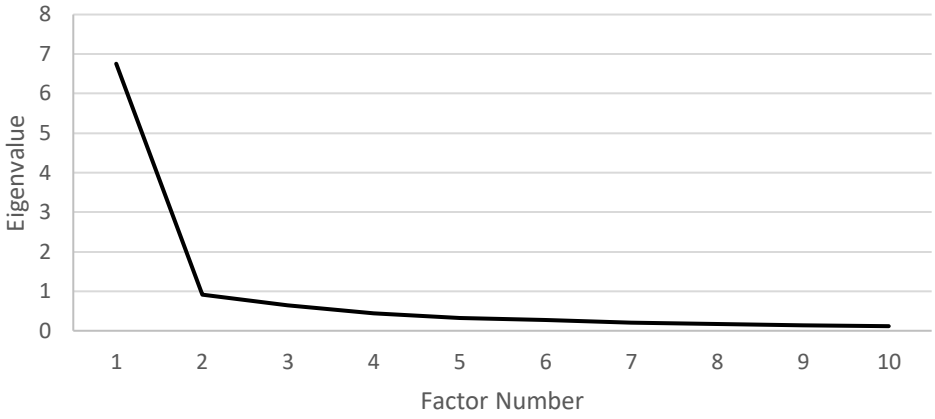
Other important demographic data in this study indicated that most (n = 41, 60.3%) of those responding have experienced some type of XR compared to those who have not (n = 23, 33.8%) or are unsure (n = 4, 5.9%). Detailed results of the study findings are presented in the next section.

Study Findings

Participant responses to survey questions were analyzed for effect and relationship to determine overall perception and acceptance of XR in flight attendant training. To examine the relationship between a qualified flight attendant's age and their perceived benefit of using XR flight attendant training, RQ1, an Exploratory Factor Analysis (EFA) revealed one main factor influenced the variance, as shown in Figure 3.

Figure 3

Scree Plot Depiction of Main Factor in XR Perception and Acceptance



Note. Eigenvalues of each factor indicate a single factor influencing the variable. The eigenvalue of the top factor is 6.76, which represents 67.55% of the variance.

Perception and acceptance were measured by the summed score of the 10 questions relating to this construct. Total scores could range from 10 to 50 with higher scores reflecting a more positive perception and acceptance. Results of these 10 questions indicate a moderate perception and acceptance with some variability to explain further (M = 35.90, SD = 9.55), as shown in Figure 4.

The survey response analyses examined three areas: demographics, any effect of age, and relationship between gaming experience and perception and acceptance scores. The results of these analyses are presented by research question for clarity.

The 10-item perception and acceptance portion of the survey revealed a Cronbach's Alpha value of $\alpha = .94$. A one-tailed Pearson correlation computation did not reveal a statistically significant relationship between age and perception scores. However, there was a weak negative correlation between these variables, $r(66) = -.172$, $p = .080$, as shown in Figure 5. The null hypothesis failed to be rejected.

Figure 4

Frequency Data for Perception and Acceptance Scores

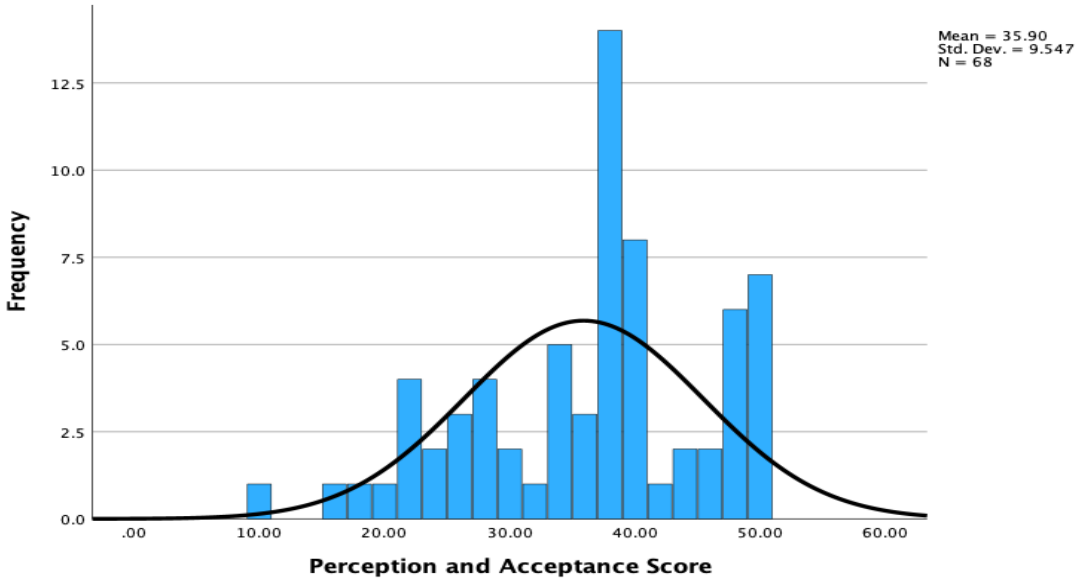
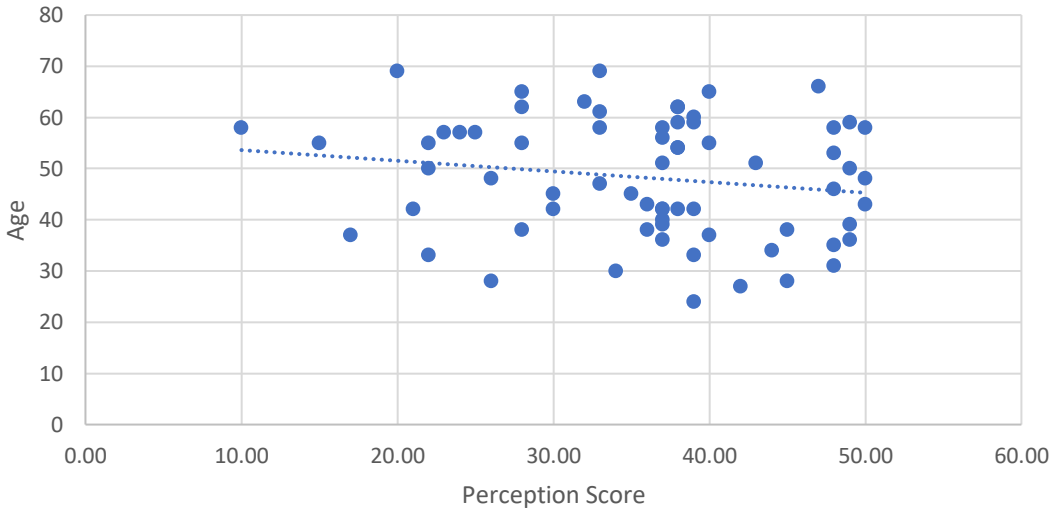


Figure 5

Correlation Between Age and Perception and Acceptance Score

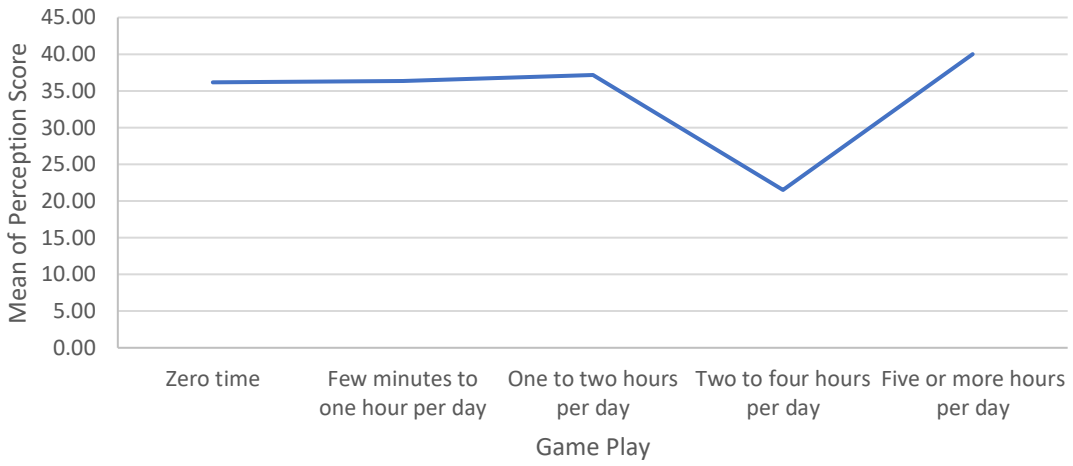


The RQ2 asked if there is a relationship between a qualified flight attendant's experience with video, computer, or smart device games and their perceived benefit of

using XR in flight attendant training. To answer this question, a one-way ANOVA computation revealed no statistical significance between acceptance score and game play experience, ($F(4, 63) = 1.24$, $p = .303$), shown in Figure 6. The null hypothesis failed to be rejected.

Figure 6

Plot of Perception and Acceptance Score and Game Play Means



Finally, participants were asked if their airline currently uses XR in certain job task training. As shown in Table 1, many of the participants' airlines do not use XR in flight attendant training. All respondents ($n = 68$) completed each question.

Table 1

Participant Use of XR in Flight Attendant Training

Question	*n*	%
My airline already uses XR in training for door operation.		
Yes	12	17.6
No	48	70.6
I'm not sure	8	11.8
My airline already uses XR in firefighting training.		
Yes	5	7.4
No	55	80.9
I'm not sure	8	11.8
My airline already uses XR in evacuation training.		
Yes	3	4.4
No	55	80.9
I'm not sure	10	14.7
My airline already uses XR in something other than door operation, firefighting, or evacuation training.		
Yes	11	16.2
No	51	75.0
I'm not sure	6	8.8

Summary

This section details the data analysis of the flight attendant survey results. A range of flight attendants, in terms of experience and age, at U.S. carriers completed this survey. The data revealed no significant findings in one's perception and acceptance of incorporating XR in flight attendant training when comparing it to one's age and experience playing electronic games. The next chapter explores these findings, the implications of those findings, and includes an overall discussion of the results.

CHAPTER 5: DISCUSSION

Overview

The purpose of this study is to understand the end user's perception of incorporating XR training into flight attendant training programs. This is an initial study in this area with a goal to establish a foundation for future studies of its kind. This study aimed to measure a flight attendant's perception and acceptance level of this type of training into flight attendant training programs by understanding any age effect or relationship with playing electronic games. In this chapter, the summary of findings, discussion of findings, the study's implications, and limitations are presented. Further, recommendations for future studies are offered as well as a comprehensive summary of the key items from this study are included here.

Summary of Findings

The key findings from this study indicate that neither age nor experience with electronic games has a direct effect or relationship with one's perception and acceptance of XR in flight attendant training. Generally, the respondents perceived and accepted XR in flight attendant training, albeit moderately. The null hypotheses for this study failed to be rejected based on the statistical results of the key constructs being examined. Next, a discussion of these findings details the nuance and meaning behind the data as well as a comparison between these findings and other research, how these findings integrate with the biblical framework presented previously, and the key points of these data.

Discussion of Findings

This study helps the field understand how open and receptive flight attendants are to incorporating a new and novel technology into flight attendant training. The

information gained through this study could help inform academia, government, and industry on best approaches to implement XR in training by first understanding flight attendant concerns. Flight attendants are trained in accordance with one of two methodologies: traditional training, or Advanced Qualification Program-style (AQP) training (FAA, 2022). This study's findings ultimately indicate a positive posture toward incorporating this training style into flight attendant training. Although the results were not overwhelmingly supportive or significant, with just being somewhat in the middle range, these are constructive and positive results because it demonstrates that flight attendants are generally not opposed to incorporating XR into training. The data also suggests that age or experience with gaming does not significantly serve as a factor for acceptance. These results could indicate that if there is perceived value and learning with XR, flight attendants may generally accept this as a viable modality.

The extant literature in applying XR as a learning modality indicates positive results in other industries. Because this study does not directly examine the effectiveness of XR as a training tool, it is difficult to directly tie these results to an assertive position that it would be effective within flight attendant training. What one does gather from this survey is that flight attendants at least seem willing to try XR and evaluate if they have learned from it in their training tasks. As other studies have shown an increase in engagement, knowledge acquisition, and information retention (Ke & Xu, 2020; Liou et al., 2017; Macchiarella, 2005; Rolando et al., 2018), this study illustrates that flight attendants believe there could be benefits to using this technology in their training. Further, flight attendants are likely to accept this type of training because their coworkers, pilots, have used training simulators for several decades, so there may already

be some level of acceptance or anticipation for this type of technological application.

When considering these results within the biblical framework presented in this manuscript, culture is the identified construct posited. Technology has propagated into many facets of daily life and has become, for some, a major tool that is a resource for communication, task completion, and entertainment. As pointed out in the biblical framework presented, critical thinking is a hallmark of God-given talent usage. The result of this survey indicates flight attendants use an apparent critical thinking schema to evaluate the use of XR in training because the results are not overly skewed positive or negative. The overall result indicates a more methodical approach to evaluating and understanding benefits before reaching such a definitive judgement.

As industry looks toward government for guidance and acceptance of new technology in training, this study primes the research into an under-examined area. It illuminates opportunities for industry and government to collaborate and understand ways to approach this topic with flight attendants but also how widely accepted it might be in those populations. Although different results were anticipated based on the hypotheses, these results indicate something that had not been considered, a middle position that is cautiously optimistic toward the potential benefits this technology might leverage in knowledge transfer.

Implications

These findings should be used as a basis for understanding with an eye toward the future of training potential. It should be viewed in a tripartite system of thinking between academia, government, and industry as each should approach the findings a bit differently. For each, there are common touchpoints that overlap, and these are the areas

identified for collaboration.

In academia, this study and the associated findings should be used as a baseline for current and future studies. This study should also be used as a baseline example of a point in time along society's journey with technology as a measurement of gestalt. In time, the perception and acceptance of such technology in training is suspected to become more skewed positive or negative, depending on the level of propagation, experience, and implementation. Equally, this study should be replicated over time and in other areas, even within academia, to understand the perception and acceptance posture among various groups, socioeconomic, and sociocultural dimensions for deeper understanding how each feel about this technology in training. These serve as common touchpoints with government and industry because translational research helps provide a path forward in testing and implementing XR intervention in training as well as informing the communication strategy that should be used within certain subpopulations divided by job type.

Government should use these findings as baseline information to begin developing guidance and strategies for industry to implement XR training and validating the results therefrom. This study serves as a primer to other studies evaluating the effectiveness and could include expansion studies on general attitudes toward each specific type of XR (AR, MR, and VR) and its use in training certain job tasks. For example, studies can explore whether flight attendants are more accepting of MR teaching evacuation training when compared to VR. These questions along with training validation can help drive a data-based decision-making model for accepting and validating XR as a training modality.

Industry should use these findings as it builds communication strategies with workgroups to understand each groups' concerns. These findings also indicate an important metric in cost-benefit analysis as it describes a general sense of openness to XR in training, which is a component to receiving some value from an investment. If a work group is already against the idea of incorporating a new training modality, it could result in ineffectiveness through resistance. Common touchpoints in industry that would help academia and government is the availability of data from internal surveys, training observation data, and trial or usage data.

Research in all three sectors can ultimately help one another reach a more conclusive decision on the best application of XR as a training modality. Each sector relies on the others to research, guide, and execute an implementation and validation strategy. The binding interest of all three is to understand if there is any value or benefit in knowledge transfer using this type of training modality, but it requires all three to work together. Lastly, this study highlighted some limitations that are important for consideration.

Limitations

This study is not without limitations. As discussed in the first chapter of this manuscript, some of the primary limitations noted include very few examples or instances of airlines implementing this technology, a lack of understanding what XR is, a lack of understanding how to apply XR in flight attendant training, an inability to generalize the results of this study among other roles or industries, survey response rate, and self-reporting accuracy.

A few airlines across the world, and only one in the U.S., are known to use some

type of XR in flight attendant training. This severely restricts the data but also exposure to the population. This limited exposure implies that participants in this study have either experienced XR casually or not at all, which could affect their ability to understand how the technology could be of value or benefit in training. Indication of this limited exposure can be deduced by examining the results of those reporting they have experienced XR in some form but also investigating the few that indicated they were not certain if their airline is using XR in training. Some airlines may choose to only use XR training in initial training or in recurrent, which might explain why a seasoned flight attendant would be unaware of its use in initial training or a new hire flight attendant who has not yet been through their first annual currency training could be unaware of XR in that training setting.

Flight attendants are a very specific subset of the population. They are markedly different than other roles in customer service based on the nature of their jobs, work environment, and significant regulatory requirements that define their role. As such, results from this population are not generalizable to other populations in certain aspects of their training, job tasks, or work environment. Although the results not generalizable in this study, it is important to continue to conduct scientific research with this population over time.

Lastly, the survey was distributed to over 440 participants but only 15.31% responded with self-reported answers. This survey may not accurately represent the thoughts and feelings of the other flight attendants who neither received nor responded to this survey. Statistically, the minimum threshold was met to reduce the likelihood of committing a Type II error, but assurance only grows with more responses.

Recommendations for Future Research

Future research is needed within the flight attendant population. Specifically, flight attendant training and the effectiveness of current and future modalities. XR in general needs more research as a training tool and most certainly within the flight attendant population. Since this study is a baseline to understand how flight attendants currently perceive and accept XR in training, it would be beneficial to conduct a follow-up survey over time to measure how that perception and acceptance has changed and what influenced that change.

Other opportunities in future research on this topic include mitigating the limitations of this study. Conducting interviews with flight attendants as well as observational data of flight attendants attending XR training could yield stronger results. Combining the qualitative and quantitative approaches in this research could provide a comprehensive and well-rounded explanation for the results. Future research on this topic could benefit from studying perception and acceptance after subjecting flight attendants to generic XR flight attendant training applications in a laboratory setting and compare those results with a control group. Additional research on information retention would be beneficial and could be accomplished by evaluating if information is coded better using XR or other training modalities.

Finally, using the results of this study in future studies may help explain certain communication strategy effectiveness with the flight attendant population. By eliminating age and gaming experience, there may be other ways to effectively communicate with the flight attendant population about any benefits or value XR training could provide.

Summary

Through this study, a gap in research was identified and addressed within flight attendant training and the modalities used for the training. Exploring XR as a training modality for flight attendants first required understanding their experience with XR, their perception and acceptance of XR in flight attendant training, and understanding if their age or game playing experience influenced or was related to more positive or negative feelings about implementing XR in their training. The results indicated that age and gaming experience were not statistically significantly related to their perception or acceptance, and generally those feelings toward XR in training were moderate. This level of perception and acceptance could indicate openness to trying the technological intervention for a stronger sense of benefits and value. Cultural underpinnings in a biblical framework seemingly supported the use of critical thinking when responding to the questions asked in the survey. However, the most significant result of this survey is the need for more research in this area to understand the effectiveness, benefit, and value of implementing XR training for flight attendants.

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APPENDIX A: RECRUITMENT EMAIL

Subject line: Is flight attendant training changing?

Body:

Hello,

I am a former flight attendant earning my Ph.D. in Industrial-Organizational Psychology. I am working on a new research study about flight attendant training, and I need your help.

Our industry has faced several challenges over the past few years, and many companies are trying to meet those challenges by exploring new ways to conduct business. In short, some companies outside our industry have been using extended reality (XR) to approach various training exercises. XR is a blanket term for some of the technology you might already be familiar with augmented reality (AR), mixed reality (MR), and virtual reality (VR). But we must start this research at the beginning, with your thoughts on introducing this technology in training.

I would appreciate your time completing a short anonymous survey that will ask you questions about yourself, your perception of the technology in flight attendant training, and your experience using electronic games.

This survey should take at most 30 minutes to complete. Participation will be completely anonymous, and no personal, identifying information will be collected.

Who can participate?

- Qualified flight attendants,
- 18 years and older, and
- Not in any leave status at least one month before taking the survey.

If you are interested in completing the survey, please click: here

If you have any questions before, during, or after taking the survey, please do not hesitate to let me know.

Thank you in advance for helping me with this critical study.

Sincerely,
Levi

Levi L. Breeding Doctoral Candidate
School of Behavioral Sciences
[redacted]
he/him/his

APPENDIX B: INFORMED CONSENT FORM

Consent

Title of the Project: Extended Reality in Flight Attendant Training: Perception and Acceptance
Principal Investigator: Levi Breeding, Doctoral Candidate, School of Behavioral Sciences, Psychology Department, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be a qualified and current flight attendant, 18 years or older, but cannot be in any leave status one month before taking this survey. Taking part in this research project is voluntary.

Please read this entire form and ask questions before deciding whether to participate in this research.

What is the study about, and why is it being done?

The study aims to understand flight attendants' perception and acceptance of incorporating technology into flight attendant training.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to complete an online anonymous survey through SurveyMonkey consisting of 20 questions that will take no more than 30 minutes.

How could you or others benefit from this study?

Participants should not expect a direct benefit from participating in this study.

Benefits to society include advancing the literature to address specific needs regarding policymaking, flight attendant training curricula, and motivation to enhance training for a knowledgeable workforce.

What risks might you experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses to the online survey will be anonymous.
- Data will be stored on a password-locked computer. After three years, electronic records maintained by the Principal Investigator will be deleted.

Is the researcher in a position of authority over participants, or does the researcher have a financial conflict of interest?

The researcher is a human factors research specialist at the Federal Aviation Administration. Data collection will be anonymous to limit potential or perceived conflicts, so the researcher will not know who participated. This disclosure lets you decide if this relationship will affect your willingness to participate in this study. No action will be taken against an individual based on his or her decision to participate or not participate in this study.

Is study participation voluntary?

Participation in this study is voluntary. Participation will not affect your current or future relations with Liberty University or the Federal Aviation Administration. If you decide to participate, you are free not to answer any questions or withdraw before submitting the survey without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please exit the survey and close your internet browser. Your responses will not be recorded or included in the study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Levi Breeding. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted]. You may also contact the researcher's faculty sponsor, Dr. Matthew Swain, at [redacted].

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and want to talk to someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

Before agreeing to be part of the research, please be sure that you understand what the study is about. You can print a copy of the document for your records. If you have any questions about the study later, you can contact the researcher using the information provided above.

APPENDIX C: FLIGHT ATTENDANT SURVEY

Disclosure: I am asking you to complete this survey to fulfill the requirements of my doctoral program in Psychology. This survey does not link any personal information about you, and your responses are anonymous. Please do not put your name or other identifying information on the survey. The results of all surveys will be analyzed and reported in a published public report. You must be a qualified flight attendant of at least 18 years or older to complete this survey.

Section 1 directions:
The following questions ask your thoughts on technology in a flight attendant training environment—specifically, using some extended reality. Extended reality is a blanket term that refers to several types of technology that blend or completely replaces the real world with digital overlays or integrations. You might recognize this as augmented reality (AR), virtual reality (VR), or mixed reality (MR). The questions refer to extended reality as XR, which could be AR, VR, or MR. When answering these questions, consider your most recent training event and the video you just watched. Complete the questions below by answering using a scale of 1 (strongly disagree) to 5 (strongly agree).

1. Think of your most recent training event where you had to demonstrate door opening/closing/arming/disarming. Using XR to learn or practice door procedures would be more beneficial than my current training.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. Think of your most recent training event where you had to demonstrate firefighting. Using XR to learn or practice firefighting techniques would be more beneficial than my current training.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3. Think of your most recent training event where you had to demonstrate an emergency evacuation. Using XR to learn or practice evacuations would be more beneficial than my current training.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

4. XR is a tool that can help flight attendants learn how to respond in non-normal situations or emergencies.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

5. XR will someday be a part of my flight attendant training.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

6. XR is a beneficial tool for me to use before I attend recurrent or Continuing Qualification.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

7. XR is a helpful training tool, more than just a game.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

8. XR would make an emergency feel more real than my current training.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

9. XR is a tool that all flight attendants can use to learn or enhance skills.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

10. XR is better than computer-based training (CBT).

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

<u>Section 2 directions:</u>
Complete the survey in its entirety only once. Select the most appropriate answer.

1. What is your current age?

2. Are you a current and qualified flight attendant?
    a. Yes
    b. No

3. Think of your last trip where you served as a working crewmember. When did that trip end (MM/DD/YYYY)?

4. Are you currently a flight attendant manager, on special assignment, or an evaluator/instructor/trainer?
    a. Yes
    b. No

5. The next question asks you to choose a description that best matches your experience with playing video or electronic games. These styles of games are those that you interact or play with on your computer, tablet, smartphone, video game console, virtual reality, augmented reality, or mixed reality. Which answer best describes your experience with playing electronic games?
    a. I do not spend any time playing these kinds of games.
    b. I spend a few minutes to one hour per day.
    c. At the most, I spend one to two hours per day.
    d. I spend about two to four hours per day.
    e. I spend about five hours or more per day.

6. I have tried at least once an extended reality type (augmented, virtual, or mixed reality).
    a. Yes
    b. No
    c. I'm not sure

7. My airline already uses an extended reality type (augmented, virtual, or mixed reality) in my training for door opening, closing, arming, or disarming procedures.
    a. Yes
    b. No
    c. I'm not sure

8. My airline already uses an extended reality type (augmented reality, virtual reality, or mixed reality) in my training for firefighting.
    a. Yes
    b. No
    c. I'm not sure

9. My airline already uses an extended reality type (augmented, virtual, or mixed reality) for evacuation training.
    a. Yes
    b. No
    c. I'm not sure

10. My airline already uses an extended reality type (augmented reality, virtual reality, or mixed reality) for some other part of training unrelated to door operations, firefighting, or emergency evacuations.
    a. Yes
    b. No
    c. I'm not sure