

Immersive Simulation Technologies in EMU's Aviation Program



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Abstract

This project aims to investigate how EMU (Eastern Michigan University) AFT (Aviation Flight Technology) students reflect on Virtual Reality (VR)-based simulators in flight training. Existing studies state that beginning flight training in a vertical space potentially saves time and money. However, there is a lack of comprehensive investigation into how flight students reflect on the new VR-based flight simulator vs traditional simulators. Hence, this project will design a survey to collect feedback from EMU AFT students regarding their experience using VR simulators vs their counterparts.

Background

- Aviation is a hands-on industry where students are required to operate aircraft and expensive equipment as part of their training. Aircraft rental costs add up quickly, and depending on the efficiency of the flight lessons, students must spend large sums of money toward their dream of becoming a commercial pilot.
- According to Crosswinds Aviation, it costs \$189/hr to rent either a DA40 or Cessna 172 not including instructor's fees, and it costs \$169/hr to rent a DA20 not including instructor's fees (Crosswinds Aviation, 2023).
- While it's true a student must fly to learn, it is not always the case. Aviation schools use immersive simulation training devices for flight training. These dynamic learning environments have numerous learning benefits for aviation students. With their different levels of fidelity and immersion, simulators provide realistic training scenarios/environments that help with enhancing procedural memory and performance while decreasing costs associated with flight training.

Introduction

- VR is a technology that allows the user to be fully immersed in the digital world. VR technology is being utilized by a variety of educational programs, especially in dynamic learning environments, to train students and novices on complex scenarios in a safe and controlled environment. The high fidelity and flexibility of VR technology can be adapted to different learning objectives.
- This study aims to use literature study findings and data to help assess the best implementation of this technology in the EMU curriculum as well as validating the existing research that suggests that there is a positive relationship between perceived enjoyment, usefulness, ease of use, attitude towards use, and performance expectancy. Based on the research conducted by Fussell and Truong (2021), "The strongest relationship was between ATU and BI, and ATU was found to be impacted positively and directly by PEU, PU, and PENJ. Understanding the relationship of these factors and how they influence user intention can inform educators wishing to use VR in a dynamic learning environment." There is potential to expand on this research to specifically evaluate how students react to actual VR flight simulators and especially how EMU students react to the technology in comparison.

Research Question

How EMU (Eastern Michigan University) AFT (Aviation Flight Technology) students reflect on Virtual Reality (VR)-based simulators in flight training

Literature review

Author/Year	Objectives	Results	Limitations
(Azam, 2022)[1]	The author states that beginning flight training with a vertical space potentially saves time and money.	The program reduced the time it took a student to solo flight by 30%.	However, there is a lack of comprehensive investigation on how flight students reflect on the new VR-based flight simulator.
(Fussell & Truong, 2021)[3]	Survey 310 aviation students from ten institutes to determine the factors that influence students to use VR for learning in a dynamic environment.	"The strongest relationship was between ATU and BI, and ATU was found to be impacted positively and directly by PEU, PU, and PENJ. Understanding the relationship of these factors and how they influence user intention can inform educators wishing to use VR in a dynamic learning environment."	Experiencing VR technology was not a requirement to participate in the study. "the results indicated that although the majority of participants were frequent users of video/computer games, their experience with VR was quite low overall, with only 35 participants using VR weekly or daily."
(Fussell & Truong, 2020)[4]	Understand how students perceive the use of augmented reality in aviation maintenance training using the original TAM.	Due to the low sample size and low reliability of the PHR measurement items, the CFA (Confirmatory factor analysis) of the pilot study was under-identified.	They did not use the VR technology, instead they relied on the survey and a video that demonstrated how the equipment was operated.
(Mariky an & Papagiannidis, 2023)[5]	Break down the process of underpinning the acceptance of technology.	N/A	A number of limitations have been discussed in TAM and its extensions over the years. The simplicity of TAM and the lack of understanding of the antecedents of technology acceptance.

Table 1. Summary of related studies.



Figure 1. EMU student conducting VFR maneuvers in conventional FRASCA RTD simulator.



Figure 2. EMU student conducting VFR maneuvers in the VR simulator (Quest 2 VR and MFS2020).

Methodology

The study is divided into two stages:

- The survey design, instructions design, and system setup is completed in stage one. The setup consists of two identical working stations, each station equipped with the following: A Dell desktop equipped with an RTX3080 graphics card, a Microsoft Flight Simulator (MFS) 2020, and an Oculus Quest 2 VR set.
- In stage two, the authors will use a convenient stratified sampling method that invites EMU flight students to experience the traditional and VR-based flight simulators in a variety of scenarios and settings.
 - 40 students will be selected from the EMU AFT program as volunteers/participants during the study. The students will be selected and classified based on their flying experience and acquired licenses/ratings in aviation.
 - The participants will be divided into two groups, one group will fly the traditional simulator, then fly the VR simulator, and the other group will do the opposite. Each participant will receive a brief introduction on how to operate the simulator, the participants will then be tasked with completing a set of different activities and maneuvers.
 - Completion of the tasks will then be evaluated and the students' feedback will be recorded using surveys. Factors to be evaluated are as follows: perceived enjoyment, perceived usefulness, perceived ease of use, perceived attitude towards use, and performance expectancy. The students' reflection will be utilized to evaluate the effectiveness of VR flight simulators in the EMU aviation program.

Discussion & Future Research

- The upcoming phase of the research is to perform the experiments and collect the data during the Fall 2023 at EMU.
- Depending on results, the authors will evaluate the possible effectiveness of such technology in the EMU AFT program.
- Future research will also aim to increase sample size and diversity of participants.

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