ENHANCING FLIGHT SERVICE SKILLS THROUGH DAVIES' INSTRUCTIONAL MODEL AND VIRTUAL REALITY: A LEARNING INNOVATION FOR UNDERGRADUATES*

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Abstract

The objectives of the study were to: 1) comparing the flight service skills before and after they had learned through traditional activities, 2) comparing the flight service skills before and after they had learned through Davies' instructional model and Virtual Reality activities, and 3) comparing the flight service skills between those who had learned through traditional activities and those who had learned through Davies' instructional model and Virtual Reality activities. The sample group was 60 second-year undergraduate students during the academic year 2024-2025 at the Science and Technology College of a Chinese university. The samples were selected by cluster random sampling. The instruments consisted of 1) the learning management plan using the traditional activities, 2) the learning management plan using Davies' instructional model and Virtual Reality activities, and 3) the assessment of flight service skills. The statistics used to analyze the

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data were mean, standard deviation, independent samples t-test, and dependent samples t-test.

The results showed that: 1) the flight service skills the second-year undergraduate students after learning through the traditional activities were higher than those before learning at the statistical significance level of .05; 2) the flight service skills of the students after learning through the Davies' instructional model and Virtual Reality activities were higher than those before learning at the statistical significance level of .05; and 3) the flight service skills of the students after learning through Davies' instructional model and Virtual Reality activities were higher than those after learning through the traditional activities at the statistical significance level of .05.

Keywords: Davies’ Instructional Model, Virtual Reality, Flight Service Skills

Introduction

Flight service skills constitute a critical competency within the aviation industry, integrating safety protocols, emergency response, passenger communication, and service management (Casner et al., 2014 : 1506–1516). The cultivation of these skills traditionally relies on high-cost flight simulators and real-flight training, posing significant economic burdens and safety risks (Kamel, 2006 : 16–22; Chittaro & Buttussi, 2015 : 529–538). For instance, simulator-based training requires substantial investment in equipment maintenance and professional operators, while limited exposure to real emergencies hinders skill mastery (Brookings et al., 2006 : 361–377). These constraints are particularly pronounced for novice trainees, who face heightened psychological stress during high-stakes scenarios (Maqsoom et al., 2023 : 1528).

The advent of Virtual Reality (VR) technology offers a transformative solution. By simulating immersive three-dimensional environments, VR enables risk-free, repetitive practice of complex flight operations—from routine passenger service to emergency evacuations (Dede, 2009, pp. 66–69; Beaubien & Baker, 2017 : 445–450). This technology not only reduces training costs by 40–60% compared to physical simulators (Onyesolu & Eze, 2011 : 53–70) but also provides scalable scenarios for diverse skill development (Rizzo et al., 2011 : 176–187). For example, VR platforms allow trainees to rehearse medical emergencies or cabin fires repeatedly, enhancing decision-making fluency without real-world consequences (Srinivasan et al., 2022 : 246–262).

Despite VR's potential, its pedagogical efficacy depends on the use of structured instructional frameworks. Davies' instructional model (1971), emphasizing systematic skill acquisition through five phases—Review, Presentation, Guided Practice, Independent Practice, and Application—provides such a foundation (Davies, 1972 : 45–82). This model aligns seamlessly with VR's capabilities: Guided Practice in VR offers real-time feedback during simulated service tasks (Brown et al., 2023 : 23–31); Application phases leverage VR to replicate high-pressure scenarios (e.g., turbulence management), bridging theory and practice (Slater, 2017 : 19–33).

However, current research lacks rigorous validation of this synergy in flight service education. While VR applications in medicine or military training are well-documented (Jensen & Konradsen, 2018 : 1515–1529), few studies have examined their coupling with evidence-based pedagogies, such as Davies' model for aviation contexts (Sun et al., 2021 : 104–115). This gap impedes the optimization of VR's educational potential.

Moreover, the dynamic nature of flight service demands that trainees not only acquire technical knowledge but also cultivate adaptive soft skills such as intercultural communication, situational awareness, and emotional regulation (Zhang et al., 2020 : 312–326). Traditional classroom or simulator training often struggles to recreate the real-time pressure, passenger diversity, and unpredictability of in-flight scenarios (Kim & Park, 2019 : 105–117). In contrast, VR allows for customized training modules that reflect diverse passenger profiles, multilingual interactions, and even rare but high-impact situations such as unruly passenger behavior or sudden medical emergencies. These immersive environments can simulate variable lighting, turbulence, or crowd noise—elements that are difficult to reproduce in traditional settings—thereby improving trainees' emotional resilience and customer service consistency (Cheng et al., 2021 : 88–101).

In parallel, educational technology research has increasingly emphasized the need for pedagogical alignment in immersive learning environments. Studies warn that without a guiding instructional model, the novelty of VR may overshadow learning objectives, leading to cognitive overload or disengagement (Makransky & Petersen, 2021 : 1–12). By incorporating Davies' model, which scaffolds learning from familiar content to complex application, instructors can ensure that VR sessions are purpose-driven and skill-specific. For instance, the Review phase reinforces prior learning before introducing new VR modules, while the Independent Practice stage promotes self-regulated learning within the simulated environment. This structured approach not only enhances skill retention but also supports assessment standardization and instructional consistency (Anderson et al., 2020 : 244–259). Therefore, strategically integrating VR within evidence-based frameworks is essential for realizing its full educational potential in aviation service training.

Objectives

1. Comparing the flight service skills before and after they had learned through traditional activities.

2. Comparing the flight service skills before and after they had learned through Davies' instructional model and Virtual Reality activities.

3. Comparing the flight service skills between those who had learned through traditional activities and those who had learned through Davies' instructional model and Virtual Reality activities.

Literature Review

The Davies teaching model is highly structured and systematic, with its core idea being to help students master skills through clear instructional steps and frequent practice. In traditional teaching models, teachers impart new content through demonstrations and explanations, while students practice under the teacher's guidance and improve their skill proficiency through independent practice (Rosenshine, 2012 : 21-23). Although this model emphasizes repeated practice for students and feedback from teachers, in high-skilled disciplines such as flight services, students often lack sufficient practical opportunities, making it difficult to enhance their operational skills in a short period. The introduction of virtual reality technology offers a solution that breaks through traditional limitations. Through VR technology, students can engage in repeated practice in immersive virtual environments, simulating various scenarios in-flight services, such as onboard services and emergency evacuation, which are typically challenging to achieve under traditional teaching models (Villena-Taranilla et al., 2022 : 100434). VR technology provides students with a safe and flexible training platform, significantly increasing their learning frequency and effectiveness.

Methodology

The research on the development of activities through Davies' instructional model and Virtual Reality (VR) to improve flight service skills of second-year undergraduate students was conducted as follows:

1. In the process of skills development, various instructional models have been proposed. One notable example is Davies' instructional model, which outlines a

structured sequence of teaching steps that enable students to quickly familiarize themselves with new skills and apply them efficiently in practical contexts. Davies' instructional model consists of four core steps designed to promote not only conceptual understanding but also mastery through repetition and continuous practice. These steps emphasize the refinement of previously acquired skills while guiding learners toward achieving fluency and precision.

In parallel, the integration of Virtual Reality (VR) technology into education has opened new possibilities for enhancing skill development. As a powerful digital tool, VR enables students to engage in immersive simulations, offering opportunities for intensive practice in safe, controlled environments—especially valuable in situations where real-world risks are present. When combined with structured models like Davies’, VR can reinforce skill acquisition by providing realistic, repeatable, and risk-free scenarios that facilitate Professional competency.

2. Population and Sample: The population in this study consisted of four classrooms with 200 second-year undergraduate students during the academic year 2024-2025. The research sample was 60 students, selected by cluster random sampling, and consisted of two classrooms. One class, 30 students, was selected as the experimental group, while another class was selected as the control group.

3. Variables: The independent variables in this research comprised two methods : 1) the traditional approach and 2) Davies' instructional model integrated with Virtual Reality. The dependent variable in this research was flight service skills

4. Research Instrument: The research instruments utilized in this study were developed to evaluate the effectiveness of traditional learning activities and Davies' instructional model integrated with Virtual Reality (RSIA) in enhancing the flight service skills of students. The instruments comprised lesson plans, learning

activities, and assessment tools, all subjected to a rigorous validation process to ensure reliability and alignment with the study's objectives.

First, the lesson plan for the traditional learning group was designed using a structured, teacher-centered approach. It followed a conventional three-step format: 1) Introduction—setting learning goals and engaging learners, 2) Learning Activity—delivering core content through lectures and demonstrations, and 3) Conclusion—summarizing key points and assessing comprehension. This lesson plan covered four essential units: 1) Basic flight service skills, 2) Emergency response and safety drills, 3) Communication skills and adaptability in-flight services, and 4) Customer service management. The plan underwent expert validation involving five specialists from curriculum design, aviation services, and educational measurement. Using the Index of Item Objective Congruence (IOC), the content achieved a validity threshold of ≥ 0.50, with the final version reflecting expert suggestions. The analysis results showed that the IOC value was equal to 1.00

Second, the lesson plan for the experimental group incorporated Davies' instructional model and VR technology. The design followed 4 key instructional steps: 1) Review of previously learned material, 2) Presentation of new content, 3) Independent practice, and 4) Application of skills in realistic VR simulations.

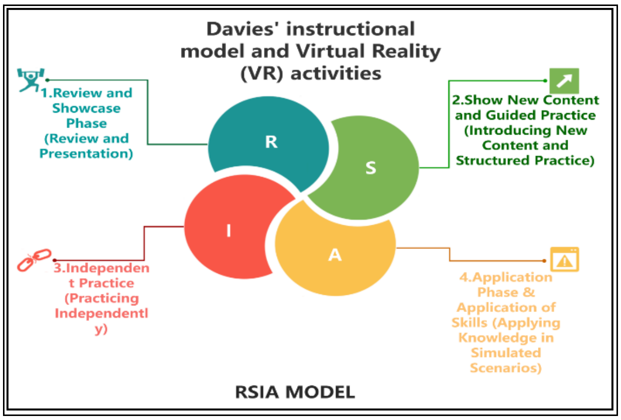

Figure 1 Davies' instructional model and Virtual Reality activities (RSIA Model)

These activities were aligned with VR phases, including a showcase, practice, and application phase, providing students with immersive, hands-on training in simulated flight
environments. Real-time feedback and scenario-based learning were integrated to reinforce skill acquisition.

The development process mirrored that of the traditional group: literature review, draft development, expert review, IOC analysis, and final revisions based on feedback. The IOC values met the required standard, which was equal to 1.00, confirming content validity.

Finally, the Assessment of Flight Service Skills instrument was developed using a rubric-based evaluation framework. This rubric measured four key dimensions of flight service competencies: (1) Service Quality, (2) Emergency Response, (3) Passenger Communication, and (4) Service Process Management. Like the lesson plans, the assessment tool underwent expert validation, with IOC values ranging from 0.60 to 1.00. To ensure reliability, Cronbach's Alpha Coefficient (α) was calculated, resulting in a value of 0.925—indicating high internal consistency. Pretests and posttests were administered to both control and experimental groups, enabling comparative analysis of skill development outcomes.

These instruments collectively ensured that the instructional interventions were pedagogically sound, aligned with educational objectives, and capable of accurately measuring student performance in flight service skills.

5. Data Analysis: The data analysis for hypothesis testing employed both dependent and independent sample t-tests. The dependent sample test was utilized to compare the flight service skills before and after the implementation of the traditional teaching method among students. The dependent samples t-test was used to assess the flight service skill before and after the application of

Davies' instructional model and Virtual Reality (VR) within the same group of students.

Furthermore, an independent sample t-test was conducted to compare the flight service skills between students exposed to the traditional teaching method and those who experienced Davies' instructional model and Virtual Reality (VR).

Results

1. The analysis compared the flight service skills before and after learning management through a traditional activity for second-year undergraduate students.

Table 1 The flight service skills of second-year undergraduate students before and after they had learned through traditional activities.

Traditional activities	n	$\bar{x}$	S.D.	t	df	Sig.
Before	30	11.13	2.430	8.109	29	0.000
After	30	14.77	2.539			

*p< .05

Table 1 showed that the students' flight service skills before the traditional activities were 11.13 ($\bar{x}$ =11.13, S.D. = 2.430), and after learning, it increased to 14.77 ($\bar{x}$ = 14.77, S.D. = 2.539). When comparing the test scores for both tests, it was found that students' flight service skill after learning management through the traditional activities was significantly higher than before at a statistical significance level of .05.

2. The analysis compares the flight service skills before and after learning management through Davies' instructional model and Virtual Reality activities for second-year undergraduate students.

Table 2 The flight service skills before and after learning management through Davies' instructional model and Virtual Reality activities.

Davies' instructional model and Virtual Reality activities	n	$\bar{x}$	S.D.	t	df	Sig.
Before	30	11.37	0.955	20.221	29	0.000
After	30	17.87	1.520			

*p< .05

Table 2 showed that the students' learning achievement in flight service skills had a mean of 11.37 ($\bar{x}$ = 11.37, S.D. = 0.955) before the game-based learning and 17.87 ($\bar{x}$ = 17.87, S.D. = 1.520). Compared with t-scores, it was found that the students' flight service skills after Davies 'instructional model and Virtual Reality activities were significantly higher than before, at a statistical significance level of .05.

3 . The analysis compared the flight service skill through learning management through traditional activities and Davies 'instructional model and Virtual Reality activities for second-year undergraduate students

Table 3 The flight service skills between traditional activities and Davies' instructional model and Virtual Reality activities.

Learning Management	n	$\bar{x}$	S.D.	t	df	Sig.
Traditional activities	30	14.77	2.539	-5736	58	0.000
Davies' instructional model and Virtual Reality activities	30	17.87	1.520			

*p< .05

Table 3 showed that the students' flight service skills had a mean score of 14.77 ($\bar{x}$ = 14.77, S.D. = 2.539) with the traditional activities and 17.27 ($\bar{x}$ = 17.87, S.D. = 1.520) with Davies 'instructional model and Virtual Reality activities. When comparing the test scores, it was found that the flight service skill of students using Davies 'instructional model and Virtual Reality activities was significantly higher than those using the traditional activities, at a statistical significance level of .05.

Discussion

1. The comparison of students' flight service skills before and after implementing the traditional method for learning management revealed that the mean score after learning was higher than the mean score before learning, with a statistical significance of .05. Traditional instruction significantly enhanced flight service skills due to structured teacher guidance and incremental practice. Instructors provided real-time feedback during learning e.g., correcting safety briefing postures, enabling immediate error correction—aligning with Jenkins, A, (2019, pp.85) teachers' actions and language become the target imitated by learners whose outlook towards right and wrong, attitude, value orientation, and academic level have a great impact on students. So, after traditional teaching, students' skills are higher than before and causing certain teaching effects. These findings suggest that traditional teaching was effective in promoting core aviation service competencies among the learners.

2. A comparison of students' flight service skills before and after using the Davies' instructional model integrated with Virtual Reality revealed a statistically significant improvement ($p < .05$). Davies' instructional model offers a systematic framework for skill acquisition, emphasizing structured phases: reviewing prior knowledge, demonstrating new content, guided practice, independent practice, and applying skills in realistic contexts. This model aligns with cognitivist theories, as repeated practice coupled with immediate feedback strengthens memory retention and behavioral automation (Davies, 1971, pp. 151-160; Rosenshine, 2012, pp. 35-36).

When integrated with Virtual Reality, it creates a dynamic learning cycle where virtual simulations provide safe environments for high-frequency drills, while the model's reflective steps deepen knowledge internalization (Jensen & Konradsen, 2018, pp. 1515-1529). Empirical studies confirm synergistic benefits of this integration. VR's immersive scenarios, e.g., cabin emergencies, passenger interactions, enable learners to transfer theoretical knowledge into practical skills, significantly improving performance in complex tasks like safety demonstrations and crisis management (Slater, 2017, pp. 19-33; Wu et al., 2020, pp. 1991-2005). Research further notes that VR increases skill retention rates, as real-time feedback and adaptive scenarios cater to individualized learning needs (Li et al., 2022, pp. 1851-1882). Such evidence positions VR-enhanced pedagogy as a transformative tool for vocational education, particularly in high-stakes fields like aviation services. Concurrently, Davies' model enforced the structured and repeated practice of each virtual scenario, ensuring procedural consistency and learner confidence.

3. The results of comparing the students' flight service skills who studied through the Davies' instructional model integrated with Virtual Reality were significantly higher than those who studied through the traditional method, with a statistical significance of .05. This may be attributed to the harmonious combination of Davies' learning management model and the potential of Virtual Reality technology. Davies' model, which emphasizes systematic skill development through five stages: Review, Presentation, Guided Practice, Independent Practice, and Application, provides a strong foundation for developing procedural knowledge (Davies, 1972, pp. 45–82).

When combined with the potential of Virtual Reality, which can realistically simulate aviation operations, students are given repeated practice in low-risk situations, ranging from normal passenger service to emergency situations such as evacuating passengers during a cabin fire (Dede, 2009, pp. 66–69; Beaubien & Baker, 2017, pp. 445–450), creating a safe yet realistic learning environment. The integration of the two approaches is designed into four main steps: 1) Service Quality, 2) Emergency Response, 3) Passenger Communication, and 4) Service Process Management. This allows students to practice applying conceptual knowledge in a simulated context that closely resembles real-world situations. Empirical studies confirm that integrating Davies' model with VR significantly improves operational accuracy and retention in skill-based disciplines (Li et al., 2022, pp. 1851–1882).

However, limited scenario diversity restricted emergency response mastery. Traditional methods failed to simulate high-risk events (e.g., cabin fires or medical crises), resulting in only marginal gains in adaptability. As Brookings et al. (2006) noted, absence of contextual stressors impedes decision-making automation gap VR technology directly addresses through immersive simulation (Wu et al., 2020, pp. 1998-2000).

Recommendation

To implement this teaching approach, two key considerations are: 1) educators should prioritize designing Virtual Reality simulations of high-risk aviation situations, such as cabin fire drills, and embedding Davies' post-simulation reflection notes to deepen metacognition; and equipping and managing Virtual Reality resources so that they can be effectively used in each learning phase. Future research should explore cross-disciplinary applications in hospitality, medical, and high-speed rail training to validate the ability to develop professional practices; long-term skill retention by tracking graduates' performance and assessing real-world crisis management capabilities; and multi-modal assessments integrating biometric data, such as VR emergency eye movement tracking, to measure the link between cognition and behavior.

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