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Transitioning From Face-to-Face to Virtual Training: Trainee Perceptions of Virtual Air Traffic Training

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TRANSITIONING FROM FACE-TO-FACE TO VIRTUAL TRAINING: TRAINEE PERCEPTIONS OF VIRTUAL AIR TRAFFIC TRAINING

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The public health emergency has adversely impacted the aviation community, resulting in reduced air traffic operations and challenges for the workforce. The Air Traffic Controller workforce has experienced interruptions to initial and on-the-job training due to social distancing practices and extended periods of reduced traffic. In response, the Federal Aviation Administration (FAA) transitioned components of its air traffic training to an online (virtual) platform to continue training and reduce delays. An initial evaluation of the FAA's Virtual Air Traffic Basics and Virtual Initial Lessons courses was conducted by examining air traffic control trainee ($N = 180$) perceptions of the virtual format. Preliminary findings suggest that trainees were satisfied with the virtual courses and found the virtual environment to be supportive of their learning and helpful for developing air traffic knowledge. Challenges of the virtual format were noted as well. Implications of the current findings for virtual training are discussed.

Effective Air Traffic Controller (ATC) training is vital for ensuring that controllers have the necessary technical knowledge and skills to manage a safe and expeditious flow of air traffic in the National Airspace System (NAS). Newly hired controllers participate in a standardized training program consisting of academic courses, lab exercises, simulations, and on-the-job training through the Federal Aviation Administration's (FAA) Air Traffic Training program. This program consists of two phases: FAA Academy and Field Qualification training. The FAA Academy serves as the initial phase of training, teaching newly hired controllers foundational air traffic principles and procedures needed for the second phase of training conducted at an assigned field location. Training newly hired ATCs is of significant interest due to the complexity of the job, the mission of providing a safe and efficient NAS, and the costly investment by the agency. Effective training ensures that the FAA can maintain a highly efficient and effective workforce that meets the skill demands of the air traffic environment.

However, the public health emergency has caused several disruptions to air traffic, and the aviation community as a whole. The International Civil Aviation Authority (ICAO; 2021) reported a 40% reduction in domestic passenger flights across North America in 2020 compared to 2019, as well as billions of dollars in lost revenue. In addition to the economic impacts, the crisis has produced unprecedented impacts on the aviation workforce, particularly ATCs. Some of the impacts on ATCs include extended periods of inactivity at work, changes to staffing procedures, temporary closure of facilities for cleaning, and changes to training requirements and procedures. Changes to ATC training included a temporary stoppage of training at the FAA

Academy, a transition from instructor-led classes to a virtual learning environment, and reduced class sizes for in-person FAA Academy training.

The FAA Academy consists of two courses, Air Traffic (AT) Basics and Initial Qualification training. AT Basics teaches trainees basic aviation and air traffic concepts, and provides an introduction to air traffic control procedures. Initial Qualification training provides option-specific training for en route and terminal (tower) controller positions. Prior to the changes, the FAA Academy utilized in-person, instructor-led training to train newly hired ATCs. However, the temporary stoppage in training resulted in a shift; transitioning parts of training to a virtual format. The entire AT Basics course was moved online to enable the delivery of basic training to newly hired controllers. Similarly, the academic components of Initial Qualification training were developed into a virtual course to maintain knowledge retention of trainees waiting to be assigned to in-person Initial Qualification training at the FAA Academy. Both Virtual AT Basics and Virtual Initial Lessons are taught synchronously over a virtual learning platform with training materials delivered primarily through instructor-led lectures and breakout room sessions (i.e., online group activities). The curriculum of the virtual courses is equivalent to the respective in-person courses. Prior to training, trainees are provided a device (i.e., iPad) that contains the software applications and learning materials needed for accessing, and participating in, training.

The FAA responded quickly by developing the virtual training courses to minimize training delays, meet staffing requirements, and maintain the safety of employees. The purpose of this study is to provide an initial evaluation of the Virtual AT Basics and Virtual Initial Lessons course through an examination of trainee perceptions of the virtual environment. Specifically, trainee satisfaction with the course(s), their perception of virtual learning, the benefits and challenges of virtual learning, and technological challenges faced by the trainees was evaluated. The data reported here provide a preliminary look at the new virtual courses. This study is a part of a larger, ongoing effort exploring the effectiveness of virtual training for ATCs.

Method

Participants and Procedure

We collected data from 180 air traffic control trainees enrolled in Initial Qualification training at the FAA Academy. Participants ($M_{age} = 26.47$ years, $SD_{age} = 2.99$ years) included trainees assigned to the En Route ($n = 55$), Tower Cab ($n = 113$), and Terminal Radar ($n = 12$) training track. Seventy-two percent ($n = 130$) of the sample had previously taken an online course (e.g., high school, college) prior to Virtual AT Basics. All participants had successfully completed Virtual AT Basics and finished Virtual Initial Lessons prior to completing the survey.

Trainees' perceptions were collected using an online survey. Using a cross-sectional design, trainees completed the survey on their first day of in-person Initial Qualification training. Participants provided consent to participate in the study prior to completing demographic questions, a training evaluation questionnaire for Virtual AT Basics and Initial Lessons, and questions about their use of technology during training. The training evaluation questions focused on different elements of the virtual environment, such as engagement, learning activities, and interactions. Participants were also asked to report their satisfaction with the course and confidence following the training. Additionally, participants described the benefits and challenges of virtual training. The survey took approximately 30 minutes to complete.

Results

Trainee Perceptions

The Virtual AT Basics evaluation questionnaire asked participants to rate items using a 4-point Likert scale (1- *strongly disagree*, 4- *strongly agree*) to indicate the extent to which they agreed or disagreed with statements about the course. Trainees agreed or strongly agreed that the online environment was easy to navigate (90%; $M = 3.11$, $SD = 0.58$), supported their learning (84%; $M = 3.02$, $SD = 0.66$), and was moderately engaging (70%; $M = 2.81$, $SD = 0.77$). Trainees also agreed or strongly agreed the training applications (e.g., learning platforms and software) used during the course were easy to use (88%; $M = 3.12$, $SD = 0.60$), supported their learning (92%; $M = 3.15$, $SD = 0.55$), and were moderately engaging (72%; $M = 2.86$, $SD = 0.77$). Finally, trainees agreed or strongly agreed the learning activities, which included lectures and individual/group exercises, were helpful for developing ATC knowledge (91%; $M = 3.12$, $SD = 0.60$), provided an opportunity to practice what they had learned (88%; $M = 3.10$, $SD = 0.65$), were engaging (82%; $M = 2.91$, $SD = 0.65$), and prepared them for the end-of-course test (82%; $M = 3.12$, $SD = 0.60$). However, roughly half of the trainees agreed the learning activities promoted interactions with other classmates (50%; $M = 2.48$, $SD = 0.80$).

Trainees, on average, were satisfied with Virtual AT Basics and rated their overall learning experience as positive on a 0 to 10 scale ($M = 7.19$, $SD = 1.84$). Additionally, after completing the Virtual AT Basics, trainees felt moderately confident or very confident about their knowledge of ATC job responsibilities (89%; $M = 3.22$, $SD = 0.65$) and ability to be successful in Initial Qualification training (84%; $M = 3.10$, $SD = 0.68$).

The Virtual Initial Lessons evaluation questionnaire also used a 4-point Likert scale (1- *strongly disagree*, 4- *strongly agree*). Trainees agreed or strongly agreed the online environment for Virtual Initial Lessons was easy to navigate (96%; $M = 3.23$, $SD = 0.50$), supported their learning (91%; $M = 3.15$, $SD = 0.65$), and was engaging (88%; $M = 3.13$, $SD = 0.68$). Trainees agreed or strongly agreed the training applications were easy to use (96%; $M = 3.18$, $SD = 0.48$), engaging (86%; $M = 3.02$, $SD = 0.64$), and supported learning (92%; $M = 3.12$, $SD = 0.59$). Finally, trainees agreed or strongly agreed the learning activities, which consisted of lecture and practice exercises (e.g., flight strip, maps), were helpful for developing ATC knowledge (97%; $M = 3.33$, $SD = 0.53$), provided an opportunity to practice what they had learned (96%; $M = 3.32$, $SD = 0.57$), were engaging (87%; $M = 3.07$, $SD = 0.63$), and promoted interactions with other classmates (82%; $M = 2.99$, $SD = 0.71$).

Trainees, on average, were satisfied with the Virtual Initial Lessons course and rated their overall learning experience as positive on a 0 to 10 scale ($M = 7.38$, $SD = 1.78$). Following the completion of Initial Virtual Lessons, trainees felt moderately confident or very confident about their knowledge of ATC duties and responsibilities (94%; $M = 3.38$, $SD = 0.59$) and ability to be successful in Initial Qualification training (94%; $M = 3.34$, $SD = 0.59$).

Benefits and Challenges

Qualitative responses provided by the participants were reviewed to identify common benefits and challenges of the virtual training. Almost 45% of trainees that responded reported training from their home as a top benefit of Virtual AT Basics. Additionally, trainees described training at home as a benefit because it offered a convenient (15%) and/or comfortable learning

environment (20%) to learn ATC material. Virtual training also afforded trainees additional time to study and/or be with family (17%) and stay safe during the public health emergency (6%). Sixty-five percent of trainees that responded, listed additional exposure to learning material before attending the FAA Academy as a top benefit of Virtual Initial Lessons, in addition to the quality of instructors (21%), learning experiences (18%), and completing training at home (14%).

The top reported challenges for Virtual AT Basics included a lack of interaction with instructors and students (34%), understanding abstract material (19%), at-home distractions and stressors (17%), disengagement (17%), and connectivity or technology issues (15%). Trainees also reported a number of challenges for Virtual Initial Lessons. Thirty-three percent of responding trainees cited lack of interaction with instructors and students as a challenge. Other difficulties included feeling disengaged and unable to pay attention to online content (20%), understanding the content (20%), and instructor-related issues (16%) that ranged from changing instructors too often to conflicting information across instructors.

Discussion

The mission-critical nature of Air Traffic Control underscores the need for effectively designed training. Trainees are required to learn foundational information to successfully advance in ATC training, and it is crucial that trainees graduate with the knowledge needed for the next phase of training and to, ultimately, control live air traffic. The purpose of this evaluation was to investigate trainee perceptions of the new virtual air traffic training. Although challenges were noted, trainee responses offer preliminary evidence that the virtual courses provide a satisfactory learning experience and meet the training requirements of newly hired ATCs. Noteworthy, however, are the inconsistencies between the survey data and the challenges described by trainees (e.g., interaction between instructors and students, understanding material, disengagement). Potential explanations for the discrepancies could be individual differences in learning preferences among trainees. Further investigation is needed to clarify and provide a better understanding of this finding.

Technology can be beneficial for training as it provides flexibility and affords the opportunity to continue training when face-to-face delivery is not viable. Prior research suggests properly designed online training can be as effective as classroom training and tends to be most effective when the course incorporates active learning, provides practice opportunities, encourages interactions, offers learners control over their learning experience, and blends content with face-to-face instruction (e.g., Sitzmann et al., 2006). Virtual training, therefore, must be designed with the right learning principles to support knowledge acquisition and retention. The design and content of training will influence trainees' information processing, attentional focus, metacognition, motivation, and emotional responses (Gully & Chen, 2010). The results obtained from this research study, in combination with recommendations from the scientific literature on training (e.g., Goldstein & Ford, 2002; Kraiger, 2003; Salas et al., 2012), were used to develop a brief list of recommendations, shown in Table 1, for virtual training.

However, as this study is an initial evaluation, some limitations should be kept in mind when interpreting the results. First, only trainee attitudes toward the virtual training environment are presented in this report. While understanding how well trainees liked the training is important, the larger research effort will also evaluate other types of subjective and objective learning outcomes (e.g., knowledge tests). Additionally, instructors' perceptions of training

quality may provide insights that differ from the trainee viewpoint. Second, the data reported in this study are from the first wave of classes that participated the virtual Air Traffic courses. As such, responses may reflect trends and attitudes unique to a newly implemented training course.

Conclusion

Training is crucial to ensuring the continued success of the ATC workforce and technology enables the delivery of training to be flexible and adaptable. As the use of training technologies continues to evolve in the air traffic domain, ongoing evaluation is needed to ensure the design and development of training provide trainees with the needed knowledge and learning experiences.

Table 1.

Recommendations for Virtual Training and Example Practices

Recommendations	Example Practices
Address instructional design before technology	Ensure training material can be taught and learned using technology (Salas et al., 2012) Use instructional principles and learning objectives to drive training design before selecting technology
Encourage interactions	Implement active learning activities (e.g., breakout rooms, discussion boards) that provide a variety of interactions Promote collaborative learning through planned interactions among trainees and instructors
Consider instructor needs	Provide training and resources to instructors for virtual learning techniques, assessing learning in virtual settings, and keeping trainees engaged Emphasize the use of feedback as a key interaction between instructors and students (Tannenbaum, Beard, McNall, & Salas, 2010)
Account for learner preferences and individual differences	Provide hands-on activities to provide trainees the opportunity to learn through doing (Gully & Chen, 2010) Offer the option of electronic or hard-copy learning materials (e.g., strip marking boards, maps)
Focus on trainee engagement	Encourage instructor sharing of real-world uses and cases of learning material (Garrison & Cleveland-Innes, 2005) Emphasize job relevance and learning outcomes to trainees throughout learning activities (Bell & Kozlowski, 2010) Leverage virtual learning features to mirror in-person classroom activities (Cannon-Bowers & Bowers, 2010)

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