Using the Autopilot during Initial Jet Transition Training: The Effects on Student Learning

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ABSTRACT

Flight students traditionally learn to pilot an airplane by being given clear step-by-step demonstrations in the correct manner and sequence so they know what to do and how to do it. Simulator training today tends to ignore that process and instead expects the new jet pilot to fly a strange aircraft at a high rate of speed without the benefit of any demonstration and to do it with a stranger in the seat next to them, while at the same time being inundated with directions from the instructor. In the early stages of jet transition training, students are unable to process information at a rate required to learn new information while tasked with hand flying the aircraft.

Air Carriers have indicated that it is not piloting skill that is lacking in incoming new hires, but rather the basic foundation of knowledge and understanding of the technology of the aircraft, working as a crew, and having a mature attitude. Students need a broader overview of a typical flight in order to stitch together a complete picture of where the airplane needs to be and how to get it there. The purpose of this study is to evaluate the effects on student learning when using the autopilot instead of while hand flying the aircraft during initial stages of training. Results were measured by analyzing knowledge test scores between a group of students that used the autopilot and a group that did not use the autopilot. The results indicated a statistically significant difference in grades between pilots who were able to use the autopilot during the first four hour simulator training session and those who hand flew the simulator.

PROBLEM & PURPOSE

Learning a new task requires focused attention to the details of the process. When hand flying an aircraft that is new to the student, it is difficult for the student to hear and apply instructions while focused on the mechanics of hand flying. The problem is in the early stages of jet transition training, students have difficulty processing information and instruction while tasked with hand flying the aircraft. The purpose of this study is to evaluate the effects on student learning when using the autopilot instead of while hand flying the aircraft during the initial stages of training.

INTRODUCTION

When new students enter the simulator training stage, they are at the cognitive stage of learning (Anderson, 1982). They are devoting attention to the location and function of the 450 or so, switches, gauges, and knobs in the cockpit. Flying the aircraft as a single task is not difficult, but that skill will quickly deteriorate when the pilot is also tasked with navigating and communicating while the aircraft is traveling at a substantially faster rate of speed from which they are accustomed. The transfer of knowledge to skill is not an immediate function (Lintern, 1995). It takes time for the student to move from the cognitive stage (acquisition of factual knowledge) to the next level, the associative stage. Any distraction at the cognitive stage brings performance to a stop. However, as practice continues, students begin to associate what they do with the likely outcome of their action. They can now understand and apply verbal instructions to their actions. This knowledge (cognitive) to skill (associative) progression reaches the automatic stage when the student can perform the tasks with little thought and instead devote attentional resources to other activities or unrelated conversation. Expecting the student to hand fly the aircraft while still in the cognitive stage of learning will delay both knowledge and skill acquisition. The initial training in a simulator is not about developing the required motor skills but rather understanding the effect control movements have on the behavior and position of the aircraft (Koglbauer, Riesel, & Braunstingl, 2016).

Furthermore, students are expected to demonstrate good aeronautical decision making skills from the start of the training, but students lack the ability to anticipate, recognize, and act (Peterson, 2006) during initial transition training. Adding the tasks associated with piloting the aircraft by hand only adds to the confusion and the student becomes frustrated and learning ceases

METHODS

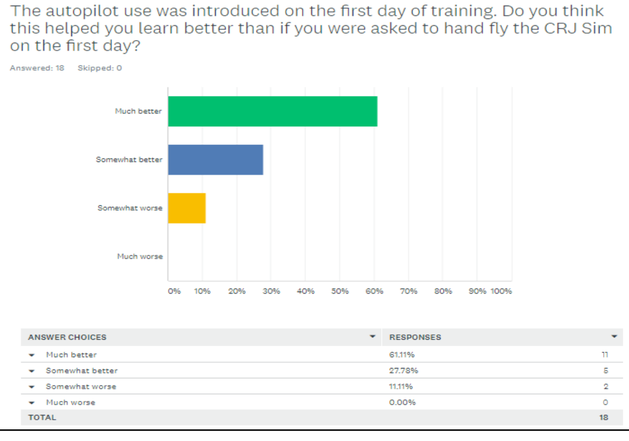
This study was accomplished in a CRJ-700 Level 6 Flight Simulation Training Device (FSTD). Two groups of students were compared. The groups were comprised of university aviation students with an average flight time of 283 hours and a Commercial-Instrument certification. There were 43 participants in the study. Group A contained 19 participants and Group B contained 24 participants. None of the participants in either group had ever been in a CRJ or air carrier type of aircraft, simulator, or FSTD. The content and delivery of the four hour simulator training session was identical for each group and delivered by the same instructor. Group A was required to hand fly the aircraft during the entire flight portion. Group B was required to engage the autopilot at 600 feet after take-off and disengage autopilot at 400' on approach to landing. Five days after the training session completion, a 40 question knowledge test was given to assess student knowledge retention and their ability to apply content and concepts presented during the flight portion of the lesson. Questions included power settings, configuration procedures and speeds, checklists and call-outs, ATC communication procedures, PFD use, V-Speeds and Ref-Speeds, approach set-up, and instrument and missed approach procedures.

RESULTS

The means of the final grades between the two groups were calculated and compared using the t-test (85.94, 95.16, p =.00002) and resulting in a t-value of 4.75. The result between groups (p = .000025) is statistically significant at p < .05.

MEANS BETWEEN GROUPS A & B p-value .000025 t-value = 4.75		
Statistic	Group A	Group B
N_1	19	24
M_1	85.94	95.16
SS	965.32	676.4
S^2	53.63	27.41

A voluntary survey of the Group B participants was conducted to obtain their impressions of introducing and using the autopilot during the first lesson. Eighty-eight percent thought using the autopilot helped them learn somewhat better or learn much better than having to hand fly the simulator on the first day.



DISCUSSION

During training when students are learning the systems and operation of an aircraft with which they are unfamiliar, students have difficulty processing incoming information and instruction. Relieving them of the need to hand fly the aircraft allows students to apply greater attention to the cognitive functions necessary to learn. This study provided instruction to two groups of very similar pilots, and the instruction was delivered in the same manner by the same instructor. Students who did not hand fly the aircraft during the initial training session performed statistically significantly better on the written knowledge assessment than the pilots who were tasked with hand flying during the initial lesson. While the ability to maneuver the aircraft was not assessed, students who used the auto-pilot demonstrated consistently superior knowledge of aircraft speed and configuration management, situational awareness and aircraft limitations.

This finding is consistent with pilot training in general. Students are only able to absorb and apply limited amounts of information during the early stages of flight training until the hands-on flying skill improves beyond the cognitive level of learning.

The results of this study were statistically significant when assessing students with a knowledge test. Students who were not tasked with hand flying the aircraft performed greater than ten percent higher on the written test than students who hand flew the aircraft during the initial instruction. While the results are promising, additional study in this area is recommended to assess the ability of the students to hand fly the aircraft during subsequent training sessions to determine the impact of using the autopilot during the first lesson when compared to students who did not use the autopilot. Continued study would be valuable in creating instructional designs that improve student learning when transitioning to high speed complex aircraft in a simulator.

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