

SYMPOSIUM 2. BEHAVIOR ANALYSIS IN TRANSPORTATION

Promoting a correct checklist use in General Aviation with Behavior Analysis Technology: A new approach

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ABSTRACT

The aim of the present study was to test the effect of contingent feedbacks on the checklist completion, delivered through a new generation mobile app designed for the flight context, both on the individual and group performance of a sample of student pilots. Preliminary data show an increase in the level of accuracy of participants after the introduction of a mobile application for the checklist management that delivered contingent feedbacks on the performance of participants.

Keywords: *Feedback, General Aviation, Checklist, Human Factor, Behavior-Based Safety*

INTRODUCTION

As in many high-risk contexts, in aviation the use of checklists is considered a crucial element for the safety of flights. The checklists are used during different segments of the flight to sequence specific, critical tasks and aircraft configuration adjustments that correspond to specific environmental demands (Degani & Wiener, 1990). Thus, an incorrect use of flight checklists is still often cited as the probable cause or main contributing factor to a large number of incidents and accidents (Degani, 1992, 2002; Degani & Wiener, 1990, 1993; Diez, Boehm-Davis, & Holt, 2003; Ranz, Van Houten, 2009) especially in General Aviation. An extensive research of the aviation checklist literature reveals only a limited number of recent studies that have examined whether behavioral interventions could increase the appropriate use of flight checklists. (Rantz et al., 2009). Although there are a number of checklist formats available (paper, laminated paper or card, scroll paper, electromechanical, vocal, computer-aided or electronic versions) in General Aviation only a limited number of advanced aircrafts have digital checklists. Research on electronic and digital checklist is still in progress

with the aim of eliminating many paper checklist errors observed, most frequently item omissions. Moreover, peculiar to General Aviation is the use of personal mobile devices not integrated into the aircraft (smart phones and iPad) that could be useful for the management of flight and to reduce the risk related to pilot workload.

METHOD

Participants

Participants in the present study were 4 student pilots attending a Private Pilot License course at Aeroclub “Bolla”, a Flight Training Centre in Parma, North Italy. Participants had an average amount of 20 hours of flight.

Materials

To provide a direct measure of the target behavior, real flight sessions were recorded with an HD video camera that was mounted inside the cabin of the aircraft to observe the participants' arm positions and hand interactions with the flight panel during each phase of the flight. For the scoring of recorded sessions, a data sheet was created on the model of the normal operations checklist of the aircraft in use to the student pilots. The intervention is based on the use of an application for mobile, specifically developed for the flight context, a checklist management app that has been implemented on a smartphone given to the pilot to use throughout the flight session.

PROCEDURE

The effect of contingent feedbacks on the checklist completion delivered through of a checklist management application (mobile app) was evaluated using a multiple baseline design. Participants were randomly assigned different baseline lengths (number of flight sessions to be recorded). During baseline sessions, participants started the training as usual with episodic, non contingent feedbacks, not related to the checklist use, delivered by the Flight Instructor at the end of every flight session. The start of the intervention was staggered across participants. During the Intervention phase, subjects received feedbacks and fixed cues by the mobile app related to the checklist use, as a plan of behavior modification. At the end of each session, participants continued to receive feedbacks on their performance during the flight session delivered by the Flight instructor, during the debriefing.

The recorded session was then collected on a personal computer to be scored by the Flight Instructor and the experimenter. The two independent scoring were evaluated with the IOA procedure. During the following sessions, data were directly collected by the mobile app in form of the time between the visual presentation of the item on the screen and the participant's screen touch to check the item. During the development and testing of the application, the minimal time for each item to be considered completed correctly was inserted. On the basis of the reference times inserted, the performance of student pilots was scored throughout the completion of each checklist subsection in order to give a feedback to the student pilot at the end of every session.

RESULTS

Figure 1 shows the total number of checklist items correctly completed per session by each participant. The performance of the first participant increased, after the introduction of the mobile app, from a mean of 96,5 items during baseline, to 127 items out of 128, nearly reaching 100% accuracy. The second participant increased from a mean of 117,83 items, during baseline, to 128, reaching 100% accuracy in the checklist completion. The third participant scored a mean of 118,67 items correctly completed during baseline,

increasing to 128 items before the start of the intervention. The total number of items correctly completed by the fourth participant increased from a mean of 105 items during baseline, to 128 items reaching 100% accuracy after the introduction of the mobile app.

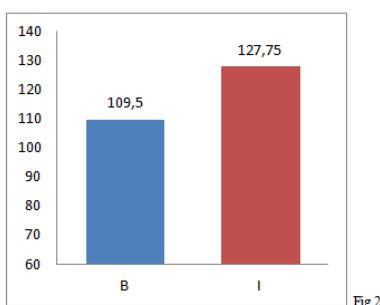
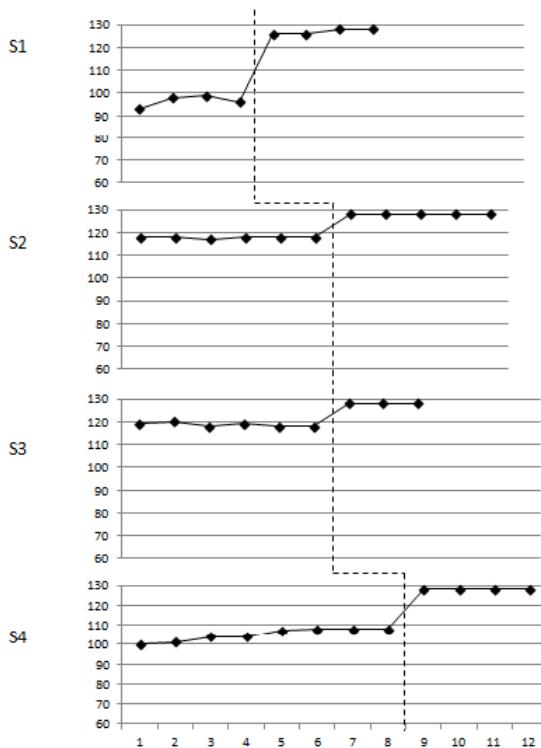


Figure 2 shows the mean number of checklist items completed correctly by participants, considered as a group. The group performance in checklist completion increased from a mean of 109,5 items (85,54%) to 127,75 items. After the introduction of contingent feedbacks and fixed cues delivered by the mobile app, the performance of all participants increased, reaching a mean number of checklist items completed correctly of 99,80%, nearly 100% of accuracy.

CONCLUSIONS

Preliminary data from the present study show that a behavioral intervention that involves the use of contingent feedbacks delivered by a mobile application, has been effective in increasing the accuracy in checklist completion per each phase of the flight in a sample of General Aviation student pilots. Only a limited number of studies in literature have considered the effect of feedbacks on the use of checklists (Rantz et al., 2009). This is the first study to further explore the effect of feedbacks, delivered through new IT solutions, a mobile application purposly designed for the flight context. The use of a mobile application can have an impact on further research studies, allowing a more accurate data collection and an immediate interpretation of behavioral data. The use of mobile devices has a great potential in the field of Aviation Safety as these solutions are flexible and cost-effective and can be tailored to users' needs and be available when needed. Future implementation of this technological solution may produce a new way to communicate and share positive practices in a social context, through the creation of an open social network. The procedure presented can be also easily applied for the behavioral modification in high-risk contexts, in production chains and in any other context in which the use of the checklist may be extremely important to safety promotion.

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Arianna Gatti is a certified Psychologist and Behavior Analyst. Member of European Association for Aviation Psychology (EAAP). Research interest: Human Factor, Aviation Psychology, Behavior-Based Safety, Aviation Safety. Winner of the 2014 “Ettore Caracciolo” Grant.