Assessment of collegiate flight training during FAA Industry Training Standards (FITS) program using technically advanced aircraft

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ABSTRACT

Collegiate flight training curriculum has changed over the past several years. The early era of flight training involved teaching pilots “stick and rudder” skills in conventionally equipped aircraft. With the arrival of the “glass cockpit” or technically advanced aircraft into general aviation, the Federal Aviation Administration (FAA) introduced FAA Industry Training Standards (FITS) curriculum that emphasized risk management, aeronautical decision-making, situational awareness, and single pilot resource management using scenario-based, learner-focused pilot training. Jacksonville University’s Aeronautics program, in cooperation with its flight-training provider, participated in the FITS curriculum from fall 2008 through fall 2011. In addition to using FITS, Jacksonville University’s flight training provider also moved to a combined Private/Instrument curriculum in technically advanced aircraft. This study examined archival student records of both FITS and non-FITS curriculum, in technically advanced aircraft and conventional aircraft respectively, to assess the role the curriculum had on student total training time and end-of-course check-ride success.

Keywords: Collegiate Aviation, Federal Aviation Administration, FITS, Technically Advanced Aircraft

INTRODUCTION

Jacksonville University's aeronautics program has been training aviation professionals for over 30 years. The program was founded in 1983 as a department within the Davis College of Business. Jacksonville University's aeronautics program is unique in that it contracts its flight training to an outside flight-training provider. The flight-training provider holds and maintains its own Federal Aviation Administration (FAA) Part 141 training certificate for both ground and flight training. In 2008, the flight-training provider purchased its first technically advanced aircraft (TAA) and received approval for the FAA's new initiative in training pilots in TAA aircraft called FAA Industry Training Standards (FITS) curriculum under a combined Private Pilot Certificate and Instrument Rating. FITS was developed as an improvement to the FAA Practical Test Standards (PTS) and in response to an accident rate, which had reached an unexpected plateau (Halleran & Wiggins, 2010).

Concurrently, with the introduction of General Aviation (GA) TAA as well as improved commercial aviation training initiatives, this prompted an updated assessment of training and licensing in the GA arena. Jacksonville University's flight-training provider participated in the FITS curriculum from 2008 – 2011. This study will examine student outcomes during the use of FITS curriculum by comparing student outcomes before and after FITS curriculum.

BACKGROUND

Before FAA FITS curriculum, Jacksonville University's flight training provider used the FAA's PTS as its standards for flight training. PTS was a maneuver-based method of assessing a pilot's competence for a specific license (Gildea, Williams, & Roberts, 2017). Students practiced specific maneuvers to the satisfaction of an instructor and then demonstrated to the examiner. The student might be proficient in that maneuver, but the application of the skill in an environment requiring judgment, decision-making, and critical thinking was taken for granted. For example, the successful demonstration of a ground reference maneuver such as turns around a point or S-turns across a road shows that a student can factor the prevailing wind into the maneuver. It was assumed that because the student has that expertise, the student could apply that skill anywhere; such as approaching an airport with a wind component that would affect the pattern and landing. PTS emphasized pilot skills (stick and rudder), and not what came to be recognized as components of Aeronautical Decision Making (ADM) (FAA, 2010; FAA, 2002; Helmreich, 1997).

It was recognized that 75% of GA accidents have a human factors component (previously described as pilot error) and that percentage has remained a steady statistic throughout the years. (Li, 2010). Training was not addressing these causal factors. The premise for pilot training a generation ago was that the 'round dial' pilot trained in the local area, remain there until gaining experience and then expand aviation horizons and boundaries. Modern GA aircraft have speeds and ranges, which give the newly licensed pilot the ability to traverse state boundaries with ease. Eventually, TAA with "glass cockpits" and GPS technology replaced GA aircraft with conventional instruments and navigation (Baranowski & Dillman, 2011). The industry expectation was that these TAA aircraft would help the pilot manage workload, decreasing task saturation and make flying safer (Nählinder, Dahlstrom, & Dekker, 2006). The reality was different. The accident rate remained constant, just the causal factors changed. (AOPA Air Safety Foundation, 2007).

GA training experts in the industry and academia-authored studies suggested the FAA revamp their training and assessment based on the leadership shown by the commercial airlines (Beckman, Callender, Gossett, Dornan, & Craig, 2008). The FAA implemented the concept of scenario-based training in limited areas of FAA assessment for licenses, and that continued to gain ground as a teaching method in GA training. The result was FITS, which has not only incorporated the aspects of ADM in scenario-based training but also included Single Pilot Resource Management (SRM) (FAA, 2007). SRM encompasses the same concept of inclusion and use of all resources available to the pilot, both inside and outside of the aircraft, as commercial airlines had done in Crew Resource Management, only in the GA arena. FITS training includes exercise and assessment of critical thinking, decision making, task and automation management and situational awareness in scenarios presented by the instructor and later assessed in the evaluation for the specific license.

Jacksonville University's flight-training provider participated in the FITS curriculum from 2008 – 2011. Before FITS, the flight-training provider had a stand-alone private pilot certificate and instrument rating syllabus using PTS and a Cessna 172. The Cessna 172 incorporated traditional "round-dial" primary flight instruments and traditional navigation. During the FITS curriculum, Jacksonville University's flight-training provider moved to a combined private pilot certificate and instrument rating using a "glass cockpit" Cirrus SR-20. The Cirrus SR-20 is a TAA aircraft with a primary flight display, multi-function display, dual Garmin 430 global positioning system (GPS), and advanced autopilot. Post FITS curriculum the flight- training provider moved back to a stand-alone private pilot certificate syllabus using PTS in a Cessna 172, and a stand-alone instrument rating syllabus using PTS in a Cirrus SR-20.

METHODOLOGY

This study comprised of one hundred three students majoring in Aviation Management and Flight Operations at Jacksonville University (JU) receiving flight training through our flight-training provider. The students were divided into three groups, 1) "PRE-FITS" which consisted of thirty-six students who received their private pilot certificate and instrument rating in a conventional "round-dial" training aircraft using PTS standards, 2) "FITS" which consisted of thirty-four students who received a private pilot certificate and instrument rating under a combined training course outline using a TAA, and 3) "POST-FITS" which consisted of thirty-three students which received a private pilot certificate using PTS standards in a conventional "round-dial" aircraft and then an instrument rating using PTS standards in a TAA. Student training records served as archival data. The researchers looked at differences between each group related to several different independent variables which included, the total number of unsatisfactory lessons, the total number of training events, the total number of review events, the total amount of dual training received, and the total amount of briefing time. The dependent variable used was the End-Of-Course pass rate for private and instrument courses/sections. Table 1 (Appendix) represents an overview of each group.

RESULTS

A statistical analysis of the dependent variable, the end-of-course practical test revealed a 75% pass rate for students completing the private pilot practical test on the first attempt in pre-FITS, a 61% pass-rate during FITS, and an 81% pass-rate in post-FITS. A statistical analysis of the dependent variable, the end-of-course practical test revealed a 40% pass rate for students completing the instrument practical test on the first attempt in pre-FITS, a 48% pass rate during FITS, and a 67% pass-rate in post-FITS. Figure 1 (Appendix) is an illustration of the dependent variable pass-rates.

A one-way multivariate analysis of variance was run to determine the effects of a student's flight training curriculum on flight performance. Five measures of flight training curriculum were assessed: the total number of unsatisfactory graded events, the total number of graded events, the total number of review events, total dual flight time given, and total ground briefing time. Students performance was assessed during their participation in one of three flight training curriculums: pre-FITS flight training curriculum, FITS flight training curriculum, and post-FITS flight training curriculum. Descriptive statistics are provided in Table 2 (Appendix).

Preliminary assumption checking revealed that the data for the FITS training curriculum and the post-FITS training curriculum were not normally distributed, as assessed by the Shapiro-Wilk test ($p < .05$). Examinations of the FITS training curriculum and post-FITS training curriculum histograms identified positively skewed data for the total number of unsatisfactory graded events, the total number of graded events, the total number of review events, total dual flight time given, and total ground briefing time. Examinations of the stem and leaf diagrams identified outliers within the FITS training curriculum for the total number of graded events, the total number of review events, total dual flight time given, and total ground briefing time. Examination of the stem and leaf diagram identified outliers within the post-FITS training curriculum for the total number of unsatisfactory graded events, the total number of graded events, the total number of review events, total dual flight time given, and total ground briefing time.

No outliers were identified within the stem and leaf diagrams for the pre-FITS training curriculum. Logarithmic, square root and reciprocal transformation techniques were used to convert the data to normality. However, attempts to transform the data to normality were unsuccessful. The one-way MANOVA is fairly robust to deviations to normality. Therefore, the outliers were not removed.

There was a linear relationship between all the dependent variables in each of the three-flight training curriculum, as assessed by scatterplot. One multivariate outlier was identified in the data, as assessed by Mahalanobis distance ($p > .001$). Again, the one-way MANOVA is fairly robust to multivariate outliers.

The differences between the flight training curriculum on the combined dependent variables was statistically significant, $F(10, 186) = 15.573$, $p < .0005$; Wilks' $\Lambda = .296$; partial $\eta^2 = .456$. Follow-up univariate ANOVAs showed there was not a statistically significant difference in Total Number of Lesson Unsats between the students from different flight training curriculums, $F(2, 97) = 1.508$, $p > .025$; partial $\eta^2 = .030$, using a Bonferroni adjusted a level of .025 as indicated in Figure 2 (Appendix). There was not a statistically significant difference in Total Number of Events between the students from different flight training curriculums, $F(2, 97) = 2.401$, $p > .025$; partial $\eta^2 = .047$ as indicated in Figure 3 (Appendix).

There was not a statistically significant difference in Total Dual Given between the students from different flight training curriculums, $F(2, 97) = .439$, $p > .025$; partial $\eta^2 = .009$ as indicated in Figure 4 (Appendix). There was a statistically significant difference in Total Number of Review Events between the students from different flight training curriculums, $F(2, 97) = 6.075$, $p < .025$; partial $\eta^2 = .111$ as indicated in Figure 5 (Appendix). There was a statistically significant difference in Total Briefing Time between the students from different flight training curriculums, $F(2, 97) = 5.693$, $p < .025$; partial $\eta^2 = .105$ as indicated in Figure 6 (Appendix).

DISCUSSION

The results of the statistical analysis show that there was a statistical significance when examining the differences between the flight training curriculums on the combined dependent variables. The researchers completed a multi-regression analysis. According to Babbie (2001), this is run to determine how given dependent variables are affected by several independent variables. This analysis concluded that three variables were not statistically significant and two independent variables were statistically significant.

The total number of unsatisfactory graded events was found to have no correlation between the three flight training curriculums; pre-FITS flight training curriculum, FITS flight training curriculum, and post-FITS flight training curriculum. The total number of training events was shown to have no correlation between the three flight training curriculums. The total number of duel given time exhibited no statistical significance between the flight curriculums.

Two variables did exhibit a statistical significance between the flight curriculums these variable were, review events and briefing time. Both of these variables had a $p<.025$. A small p-value (typically ≤ 0.05) indicates strong evidence of significance (Babbie, 2001).

CONCLUSION

After assessing the students' performance during the three flight training curriculums, pre-FITS flight training curriculum, FITS flight training curriculum, and post-FITS flight training curriculum, the authors of the paper can conclude that unsatisfactory graded events did not increase with the different flight training methods implemented to the students. The statistically significant differences in Total Briefing Time and Total Number of Review Events was a result in an increase to the number of lessons and allocated hours in the flight training providers syllabus. However, this did not correlate to fewer unsatisfactory graded events. Further research into the type of aircraft used during FITS, flight instructor training, and the combining of FAA certificates and ratings must be done to conclude an overall assessment of the FITS program.

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APPENDIX

Table 1

Study Groups

GROUP NAME	AIRCRAFT	SYLLABUS	TIMEFRAME
PRE-FITS N =36	Round-Dials	FAA Part 141 using PTS	2005-2008
FITS N=34	TAA	FAA Part 141 FITS Private/Instrument	2008-2011
POST-FITS N=33	Round-Dials (PVT); TAA (INST)	FAAPart 141 using PTS	2011-2014

Figure 1

Dependent Variable Pass-Rates

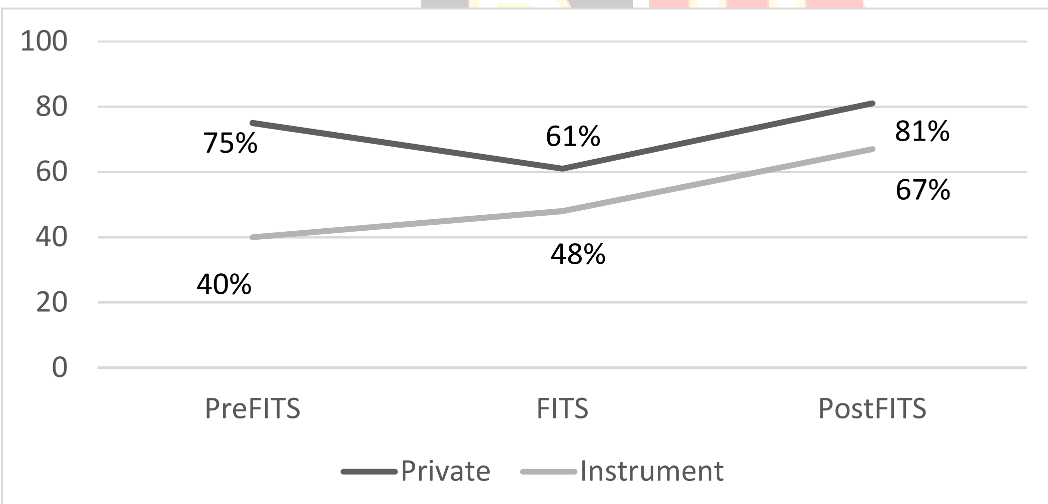

Table 2

Descriptive Statistics

Variable	Curriculum	Number	Mean	Std. Deviation
Lesson Unsats	PreFITS	17	6.287	4.376
	FITS	12	4.182	3.575
	PostFITS	15	5.218	5.084
Training Events	PreFITS	168	122.943	22.712
	FITS	154.00	109.636	23.211
	PostFITS	158.00	123.187	18.425
Review Events	PreFITS	39	15.143	10.192
	FITS	20	9.455	6.359
	PostFITS	19	5.969	5.462
Dual Given	PreFITS	156.1	112.886	17.633
	FITS	139.1	104.9	18.481
	PostFITS	165.3	111.019	23.078
Briefing Time	PreFITS	113.4	79.386	15.689
	FITS	152.75	88.546	28.892
	PostFITS	109.75	94.471	11.705

Figure 2

Total Number of Lesson Unsats

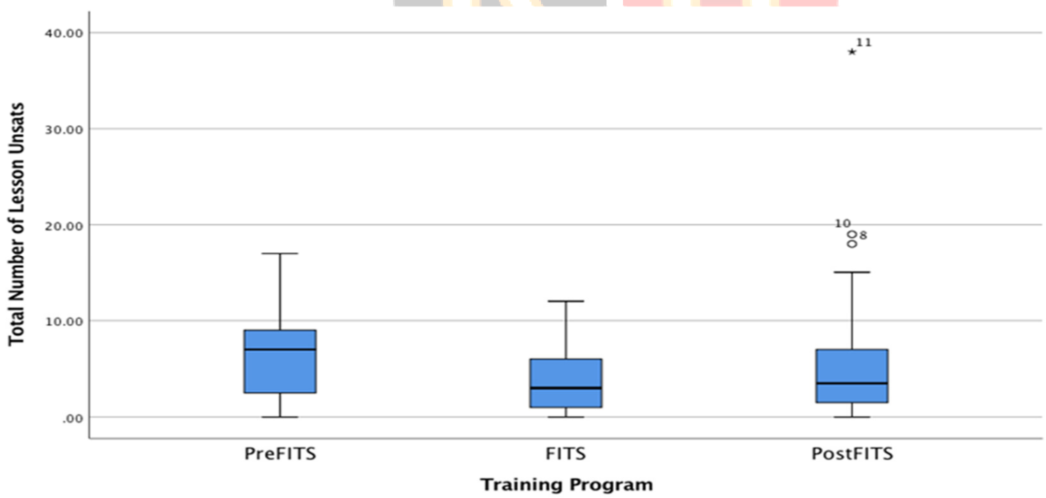

Figure 3

Total Number of Events

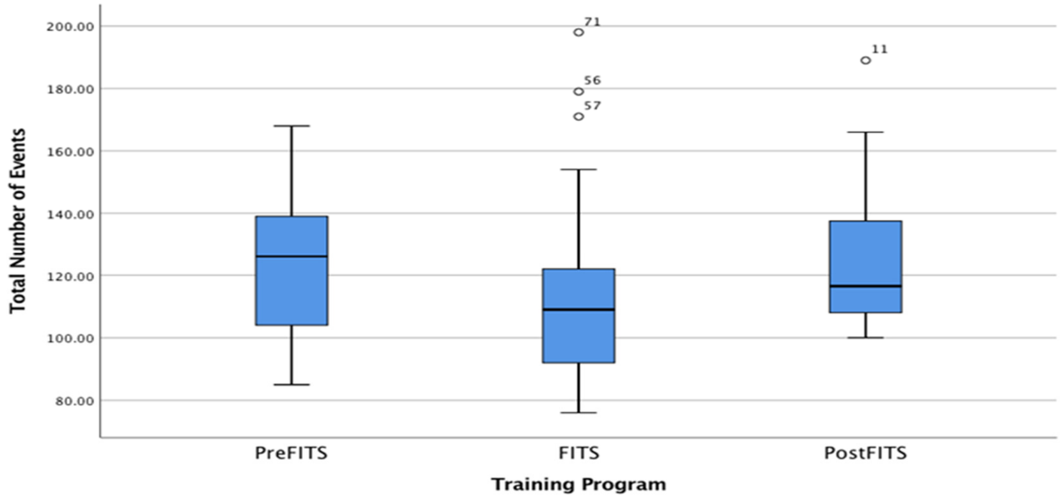

Figure 4

Total Dual Given

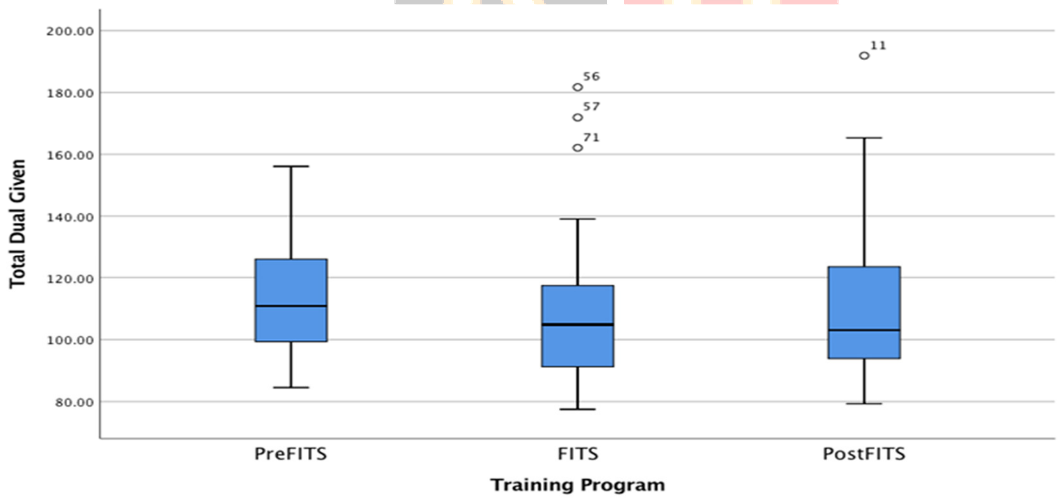

Figure 5

Total Number of Review Events

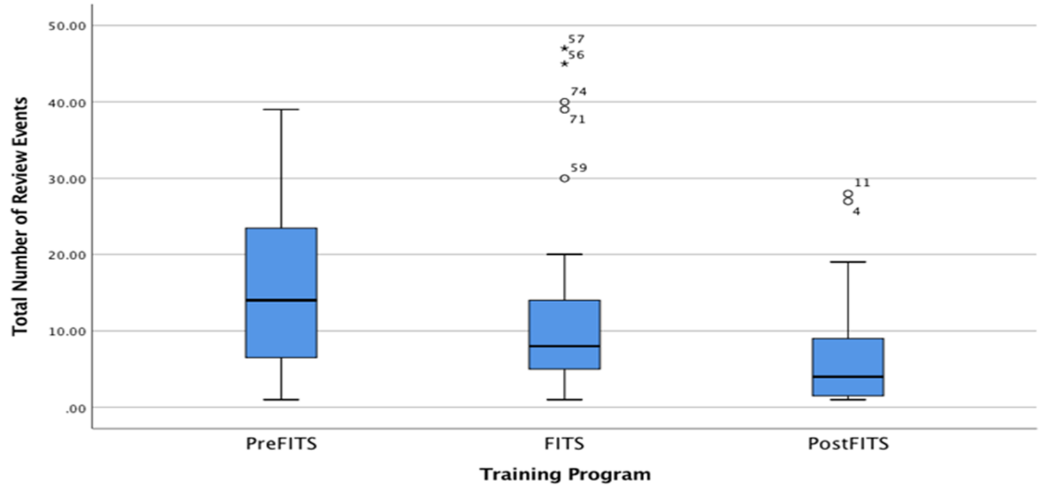

Figure 6

Total Briefing Time