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Time and Cost to Complete Instrument Training Based on Flight Block Times

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The optimization of flight training operations at higher educational aviation institutions can be helpful in increasing the efficiency at which student pilots attain their certification and help supply more pilots into the industry. Large training institutions usually offer students certain blocks of time to conduct their training. At these schools, the Instrument course is usually administered during daytime or nighttime flight blocks. The purpose of this research study was to analyze if there was a significant difference in the overall cost to complete the Instrument course during the day compared to at night. One independent sample *t*-test was conducted; the parameters selected were Two-Tail, with a sample size of 128. Archival data records of higher educational aviation institutions were analyzed, and the results show that it costs, on average, around $1,100 less to complete the Instrument course in night flight blocks compared to day flight blocks. This research paper demonstrated how flight block times can significantly impact the cost of completing the Instrument course at aviation universities and highlighted factors that led to these results.

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Introduction

Many university flight programs assign students to specific flight blocks. It is very common for a regular day to be split among blocks of about two hours, starting from around 6 a.m. up until midnight. Each semester, a student signs up for one of these flight blocks and gets an instructor assigned to conduct training activities during that specific block of time. For the purposes of this research paper, blocks from around 3 p.m. to 8 p.m. were grouped together and considered the daytime block (as they occur earlier in the day), while the blocks beginning around 8 p.m. and extending through midnight were combined and considered the nighttime block. As most flight blocks between Sunrise and 3 p.m. are reserved for flight courses that greatly require outside visual cues (like Private, Commercial, or Flight Instructor courses), the Instrument course is rarely administered before 3 p.m. For this reason, the first block of the Day group began at 3 p.m. The Instrument course of study at higher educational aviation institutions is comprised of a combination of one-on-one oral activities, simulator sessions, and flight activities; each of these activities is conducted in the specific block assigned between students and their instructors.

Per the Federal Aviation Administration (FAA) testing requirements, Private and Commercial pilot courses include flight maneuvers that must be performed primarily using outside visual references, most of which must be conducted during the daytime (FAA, 2018). The Instrument course, however, is almost entirely conducted with little visual reference outside the airplane but rather mainly by reference to flight instruments. For this reason, aviation colleges that have a high need for scheduling optimization can greatly benefit from placing Instrument students in nighttime flight blocks while reserving daytime blocks for Private, Commercial, and Certificated Flight Instructor (CFI) students.

Such a scheduling arrangement might be beneficial for the organization, but occasionally, students might be apprehensive about enrolling in a flight course that takes place at night. Factors such as fatigue, stress, and general discomfort from the lower visibility environment found at night may cause a negative impression on students if assigned a flight block later in the night compared to an earlier one.

Additionally, humans greatly depend on a 24-hour clock circadian mechanism to regulate bodily activities, coordination, and rest (Mahoney, 2010). Engaging in flight training outside of a normal morning-to-afternoon schedule could have an effect on students' sleep and eating schedules, as well as interfere with other classes, homework duties, or roommate schedules. Flying at night does pose some challenges to pilots, but it also may include potential benefits to students, especially in a high-volume training environment (Graeber, 1988).

Archival data from higher educational aviation institutions was used to make a comparison in the overall cost to complete the instrument training course between day and night flight blocks. An analysis of cost was made, which describes the overall amount paid from the start to the completion of the course.

Review of Relevant Literature

Regarding the progression of the Instrument course at higher educational aviation institutions, little is known about how flight block times and nighttime flying can play a role in the overall course of the training.

Night flying is demonstrated in literature to be more challenging to the human body than day flying. Burnside (2013) mentions how humans are naturally not well adapted to performing complex tasks in a low-visibility environment, which is commonly found at night. Nonetheless, flying at night can pose an array of benefits, especially if performed in the right conditions and with the right operational knowledge and equipment.

Although flying at night could be less attractive to students (especially as many of them have early morning classes or other scheduling duties), having the knowledge of how training efficiency changes according to flight block time can help students decide more carefully and informatively which Instrument flight block to sign up for.

The following literature covers a broad overview of sleep and how pilots are affected by the quality of sleep during the hours preceding a flight. Next, a study of the cognitive performance of several F-22 pilots flying during the day and night was reviewed, followed by an analysis of the sleep schedule and an overview of the potential drawbacks and benefits of flying at night.

How Quality of Sleep Affects Pilots

Flying is an endeavor that poses several challenges to pilots. As pilots are in ultimate control of the safety and outcome of the flight, it is important to ensure pilots are physically fit to act in their duties as Pilots-in-Command. The Illness, Medication, Stress, Alcohol, Fatigue, and Eating (IMSAFE) checklist is a method through which pilots can analyze if they are physically fit to fly, and sleep is one of these components crucial for aviation safety (FAA, 2023).

Drury et al. (2011) conducted a study to analyze how the amount of sleep affected pilots in regular air carrier operations. In this study, 302 legs of commercial flights were observed, and flight crews were observed and tracked for instances of Heightened Emotional Activity (HEA). Accident investigation reports continually point to the relationship between HEA and safety related aviation events, so the more amount of recorded HEA events in flights point to an increase in overall risk (Drury et al., 2011).

Captains and First Officers both had an average of about seven hours of sleep in the previous 24 hours, with a Standard Deviation between 1.18 and 1.43. Results showed that restricted sleep (less than five hours) was associated with higher instances of confusion, stress, and frustration. Within the previous 48 hours, restricted sleep (less than 12 hours) was associated with higher instances of unease and frustration (Drury et al., 2011).

These results demonstrate how restricted sleep can have negative consequences on flight crews and how important it is for pilots to ensure they have had sufficient rest before a flight.

However, this study did not specify what time of day pilots slept or if there was any difference in cognitive performance among pilots who flew during the day compared to those who flew at night.

Daytime and Nighttime Flying Comparison

Combs et al. (2021) conducted an experiment to analyze the psychological and cognitive performance of F-22 pilots during daytime and nighttime flying to determine if either situation was related to an increase or decrease in stress, performance accuracy, or test scores. Tests administered included the National Aeronautics and Space Administration-Task Load Index (NASA-TLX) inventory and a go/no-go (GNG) test. A total of 17 qualified F-22 pilots participated in a two-week-long experiment in which the researchers hypothesized that there would be a measurable difference in stress, performance, and overall exam scores among the two groups (day and night group).

Participants were, on average, 36 years old and had an average of 1,745 flight hours. Following completion of the experiment, neither group showed any significant difference in elevated cortisol levels (associated with higher stress levels). The authors also mention that these results observed were surprising, given that night flying is generally perceived to be more stressful than day flying; reasons that could have influenced these results include the fact that day flying requires more vigilance for traffic separation, is more susceptible to turbulence and G-forces, and is also subject to a more dense volume of traffic (Combs et al., 2021).

Two factors that were significant in this study are stress and cortisol levels, which were measured among participants as they relate to age and total time in aircraft. Participant age had a negative correlation with stress, as younger pilots tend to feel more stressed during flights than older pilots. Cortisol levels were also negatively correlated with total flight hours, showing how more experienced pilots tend to be more at ease during flight (Combs et al., 2021). Nonetheless, no significant difference was found in any of the measured parameters between participants who were observed flying during the day and those flying at night.

Sleeping Late and Alertness

Sleep and alertness are two crucial factors that affect pilots, especially while flying at night. But pilots engaging in nighttime flying also must alter their schedules to stay awake later in the evening and, in turn, wake up later in the morning/afternoon. In the early 2000s, a 21-year-old Australian army officer cadet who displayed severe instances of daytime sleepiness was diagnosed by two sleep specialists. His regular sleeping schedule was from 3 a.m. to 12 p.m.; the purpose of the diagnosis was to find what the cause of his excessive daytime sleepiness was, and if his sleeping schedule had any effect on his consistent drowsiness and sleepiness during the day (Smart & Singh, 2006).

The patient's sleep quality was tested through polysomnography (PSG) studies, and despite the officer’s later sleeping habits, there was no significant evidence of disruption to normal sleep. The patient was medically diagnosed, and instances of narcolepsy or idiopathic hypersomnia were both tested. It was considered that the patient most probably suffered from independent narcolepsy, delayed sleep-phase syndrome, and Idiopathic hypersomnia (Smart & Singh, 2006). Thus, his sleeping schedule alone did not play a role in his daytime sleepiness.

Drawbacks of Night Flying

Flying at night can be slightly more challenging to pilots due to the physical limitation that humans are inherently better at performing tasks in well-lit, high-visibility settings. While flying at night, pilots are susceptible to more vestibular and visual illusions than during the day. The Black Hole and Autokinesis illusions are only pronounced at night, and the Runway Width, False Horizon, and many of the other daytime illusions can be further intensified and more hazardous at night (FAA, 2023). As such, flying at night requires humans to compensate for the lack of performance in other ways (Burnside, 2013). Being more vigilant, combining inside and outside references more carefully, flying an instrument approach, or closely monitoring Runway Visual Glideslope Indicators are some of the ways that pilots can mitigate the risks involved with flying at night (FAA, 2023).

Other potential drawbacks of night flying include having to fly for longer hours, across various time zones, and across extensive featureless terrain. Staying alert and having sound knowledge and understanding of these factors and other pitfalls of flying at night can greatly help reduce the risk of encountering dangerous situations when flying at night. As most humans follow a 24-hour clock circadian mechanism under which bodily activities, coordination, and rest are regulated, flying during late hours could interfere with this natural daily body cycle (Mahoney, 2010). A common misconception is that sleeping late can induce more fatigue, even among healthy and experienced pilots. Nonetheless, as demonstrated in literature by Smart and Singh (2006), even with a sleeping schedule skewed to later evening hours, no difference was observed in fatigue, daytime sleepiness, or any other cognitive drawback in the tested participants.

Benefits of Night Flying

Previous research has shown how stress levels, fatigue, cognitive ability, and decision-making were not significantly different between pilots flying during the day compared to those flying at night. Results from Combs et al. (2021) demonstrate how there were no significant differences in reaction time, accuracy, test scores (NASA-TLX exams), and stress levels between day and night flying pilots. Moreover, stress response among daytime pilots was observed to be slightly higher than that of those flying at night, even though the researchers suggest a larger sample size would be beneficial to more accurately expand on the research (Combs et al., 2021).

Due to the dimensions of busy airspaces where various higher educational aviation institutions can be located, a very high number of training aircraft can be concentrated daily into a relatively confined area suitable for training and maneuvers practice.

Airspaces in the immediate vicinity of large airports can include Military Operating Areas, Restricted Areas, Special-Use Airspaces, and various Class B and Class C airspaces. Confined areas can cause a large number of training aircraft around these institutions to remain highly concentrated; many times, the volume of traffic in these areas is so high that they have been designated as Alert Areas on pilot Navigation Charts.

Traffic conflicts are common in these highly saturated locations. Many aviation universities have safety departments equipped with safety reporting systems and traffic conflicts consistently rank among the highest reported safety occurrences experienced by flight instructors and students. As evidenced in research, even highly experienced F-22 pilots are negatively affected by pressure to visually identify foreign conflicting objects and avoid them while flying, which is a key contributor to the activation of stress response while flying (Combs et al., 2021).

One potential benefit of night flying covered in the study includes the fact that the volume of air traffic at night is considerably less than daytime traffic. Traffic is a factor that greatly affects flight students in a training environment, as well as airspace congestion and air traffic control (ATC) delays. These can significantly increase the overall cost of conducting flight training operations (Houston, 2016).

In a statistical analysis of the busiest times at major airports across the world, Boromisa (2018) shows how the least busy times across airports are from 9 p.m. to 5 a.m. daily. Traffic considerably increases from 6 a.m. to 7 a.m. and is heavily saturated until 9 p.m. in nearly all airports analyzed. A student with an Instrument flight block during these times may experience significantly more delays than a student who has a flight block during the non-peak hours of the day. Since students are charged according to how many hours the aircraft's engine is running, ground and air traffic control delays significantly affect the overall cost of that flight activity.

Combs et al. (2021) also mentions turbulence as a potential drawback of daytime flying. During the day, the ground heats up and this causes the air to rise. Rising air, in turn, can create thermals across the ground, as well as generate an unstable atmosphere (FAA, 2022). As the sun sets and the ground cools, nighttime flying usually offers pilots a more stable atmosphere to fly in, characterized by fewer updrafts, turbulence, and instability.

Even among experienced F-22 pilots, repeated G-forces felt during daytime flying played a role in the increase in cortisol levels experienced by daytime flying pilots. Reasons for this can mainly be linked to prolonged sustained muscle contraction on the flight controls and more careful watch of flight instruments necessary for maintaining altitude and heading assignments (Combs et al., 2021).

One further potential drawback of daytime flying highlighted in the study conducted by Combs et al. (2021) was the need for increased vigilance for unknown traffic. Pilots rely on a concept called "See and Avoid." This means that pilots must always look outside for other traffic (as weather conditions permit) and take any necessary measures to avoid a conflict in their flight path. As the volume of air traffic is higher during the day, pilots must maintain a more careful scan during prolonged periods of time when compared to flying at night.

Methodology

This study aimed to analyze the training of Instrument Rating students at higher education aviation institutions in the United States and examine if there was a change in the overall course completion cost in U.S. Dollars for students who have flight blocks during the day compared to students who have flight blocks at night. The methods of measuring cost include analyzing the total cost for completion of the course. Although the institutions involved in this research will remain undisclosed, a few examples of large aviation universities in the U.S. include Embry-Riddle Aeronautical University, the University of North Dakota, Purdue University, and Auburn University.

An independent samples *t*-test was used to analyze if there is any significant difference in cost between students who have flight blocks during the day and night. As a *t*-test was conducted, the research analyses aimed to find differences between the two groups. Participants for these two groups were randomly selected. Although no physical contact was established between the researcher and the participants involved, IRB approval was received for the purposes of this research project. This annex will not be included to preserve the confidentiality of the institutions involved, per their request.

Participants were selected from a pool of students who had already graduated from their instrument course at aviation universities. Per G*Power tests, data from 64 students was required to be used in each group (day and night flight blocks) for a total of 128 participants. In order to ensure randomization, data was used from four previous academic semesters so as to include both Spring and Fall college terms. Using data from various previous semesters not only increased the sample size but also allowed more data from different students to be analyzed, thus increasing the randomization of the sample.

This research comprised data from 234 participants, exceeding the minimum requirement per G*Power tests. There was a total of 91 students in the day group and 143 students in the night group. The participants included male and female students of multiple different nationalities, including a majority portion from the United States, South Korea, Saudi Arabia, and India. The parameters selected for the test were Two-Tail, with an Effect Size of .5 and with an Alpha Level of .05.

All the students were de-identified, and their personal information (such as first and last names and student ID numbers) was known only to the researcher, which kept this data confidential. Furthermore, there were students who either had to repeat the course or switched flight blocks at some point during their training. The data from these students was not used; they were individually identified and deleted by the researcher. The only data used was from students who remained in a day or night flight block throughout the entire course of their Instrument training.

Descriptive Statistics

Means for completion cost were recorded in U.S. Dollars, as well as Standard Deviation, Range, and analyses of any potential outliers. The Means and Standard Deviation of the two reported groups between day and night flight blocks were then displayed through the use of bar graphs for easy visualization. Additionally, *t*-test outputs, bar graphs, and tables were added for easier interpretation of data. Although hourly rates might have varied slightly among institutions, the primary focus of this study was the relationship between Day and Night overall cost and not cost difference among different programs or institutions. As per the request of the universities involved, their identities and hourly rates must remain undisclosed.

The Day group was comprised of the flight blocks that began at 3 p.m. (and each lasted for two hours), as these flight blocks occur earlier in the day and are characterized by sunlight throughout most of the year. The Night group included the blocks that started at around 8 p.m., and each lasted for about two hours, as these blocks take place later in the night and are characterized by a generally dark setting throughout most of the year.

Hypothesis Testing

An Independent samples *t*-test was used to analyze if there was a difference in total completion cost. The following null hypotheses were tested: There is no significant difference in the cost of completing the Instrument course at higher educational aviation institutions between students who have flight blocks during the day compared to students who have flight blocks at night. It was assumed that the data was normally distributed, as the Dependent Variable was normally distributed. Participants were randomly selected, and the values of one student did not affect the values of any other student. There were no significant outliers, as the data from these students was not used. Equal Variance was tested through the SPSS output.

Results

This section presents the results of data analysis for this research project by highlighting the mean amount of money spent by students to complete the Instrument training. Hypotheses that were statistically significant were shown under both descriptive statistics and hypothesis testing sections. The section is composed of Descriptive Statistics first, followed by Hypothesis Testing. These sections include tables and graphs to better illustrate the numbers and values assessed in the various discussion topics.

Descriptive Statistics

The data used to obtain the cost of completing the Instrument course was sourced from higher education aviation universities. Although exact demographics information is not kept by the different flight schools assessed, a general record of registered student demographics can be generalizable to the flight departments. All of the participants were students enrolled in Undergraduate or Graduate courses of study at aviation universities, along with the Instrument course. Data was used from four semesters, to include both Spring and Fall college terms.

Table 1
De-Identified Small Sample of the Data Output collected from the Flight Departments

NAME	GROUP	BLOCK	DUAL	FTD	ORAL	COST
Student X	D	Day	31.1	41.1	47.3	$19,376.58
Student X	D	Day	48.5	32.7	32.6	$22,514.25
Student X	D	Day	41.9	42.8	25.1	$20,743.89
Student X	N	Night	31.2	25.9	19.3	$15,051.70
Student X	N	Night	40.3	37.2	22.4	$19,567.92

Note. Total Cost includes Oral, FTD (simulator), and Flight Time. Cost to complete the course.

Table 1 above shows an example of the data output collected for five of the 234 participants.

Table 2
Descriptive Statistics for the Cost of Completion of the Instrument Course

Flight Block	Variable	*N*	*M*	*SD*	*Min*	*Max*
Day	Cost	91	17366.13	2715.24	12368.97	23909.52
Night	Cost	143	16263.85	2040.50	12242.18	21307.33

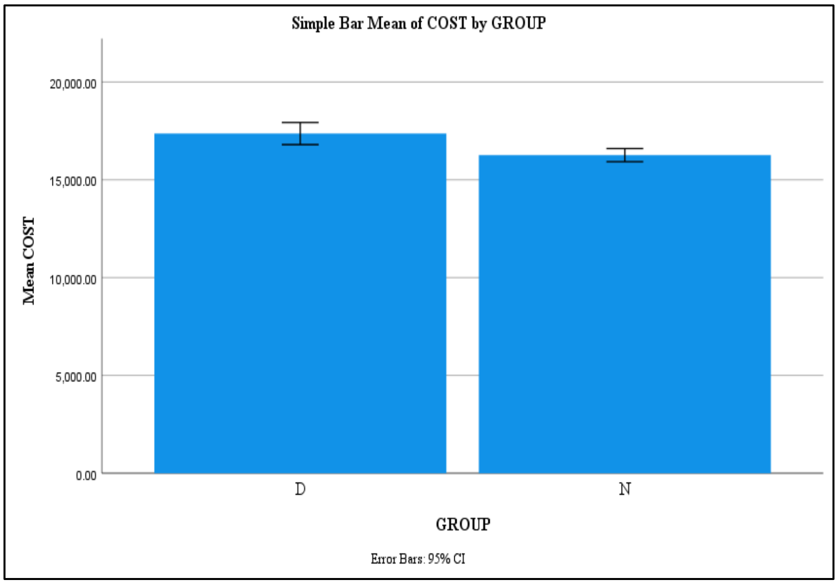
According to Table 2, the average cost to complete the Instrument course during the Day (M = 17,366.13, SD = 2,715.24) was higher than the cost to complete the Instrument course at Night (M = 16,263.85, SD = 2,040.50). The timeframe for data collection included the Spring of 2023, Fall of 2022, Spring of 2022, and Fall of 2021. The lowest amount of money spent on the Instrument course during the day was $12,368.97, while the lowest amount of money spent to complete the Instrument course at night was $12,242.18. The highest amount of money spent on the Instrument course during the day was $23,909.52, while the highest amount of money spent to complete the Instrument course at night was $21,307.33. Table 3 below depicts the skewness and variance observed in the data regarding the cost to complete the Instrument course between the two flight blocks.

Table 3
Skewness and Variance

Flight Block	Variable	*N*	*Variance*	*Skewness*
Day	Cost	91	7372521.54	.371
Night	Cost	143	4163628.25	.203

Figure 2 below depicts the average cost to complete the Instrument course. The bar denoted as D depicts the Day flight block, while the bar depicted as N indicates the Night flight block. The Error Bars show how the data has small variability and that the mean is stable.

Figure 2
Average Amount of Money Spent to Complete the Instrument Course



Note. The letter D represents the Day group, while N represents the Night group.

A Shapiro-Wilk test was conducted to analyze the normality of the data used to determine the cost of completing the Instrument course. Although the data does not indicate normal as per the Shapiro-Wilk test, skewness does not indicate excessive departure from -1 to +1. Furthermore, since an Independent Samples *t*-test is a robust statistical analysis, the decision was made to continue with the experiment analysis through an Independent Samples *t*-test.

Table 4
Shapiro-Wilk Test of Normality

Group	Variable	*Statistic*	*df*	*Sig.*
Day	Cost	.139	91	.000
Night	Cost	.076	143	.043

For all the values used in these analyses, although the data was found to not be normally distributed, the decision was made to continue with the Independent Samples *t*-test for the reasons depicted above.

The values of one student did not affect the values of any other student. For the purposes of this research, the Dependent Variable was a continuous variable. The two groups were independent from each other, and the Independent Variable was categorical. There were two outliers in the Day group and one outlier in the Night group. The following table shows Levene's Test of Equality of Variance and how it is significant based on a value of $p < .001$.

Table 5
Levene's Test for Cost to Complete the Instrument Course

	F	*Sig.*
Cost	14.52	.000

The null hypothesis was that there was no difference in overall cost to complete the Instrument course at higher educational aviation institutions between students from Day and Night flight blocks. The assumption of equality of variance was tested. Levene's test of equality of variance was significant ($p < .001$), and thus, an adjustment to degrees of freedom was made.

The mean cost for completing the Instrument course at Night (M = \$16,263, SD = \$2,040) was lower than the cost for completing the Instrument course during the Day (M = \$17,366, SD = \$2,715). An Independent Samples *t*-test was significant at the Alpha Level of .05, $t(3.535) = 14.52$, $p < .001$. Therefore, the null hypothesis was rejected. Cohen's d = 0.207, which was a medium effect. Table 6 below shows the output results obtained from SPSS for the Independent Samples *t*-test. As the lower and upper values do not show zero, this depicts significant results.

Table 6
Output Results for Cost to Complete the Instrument Course

	t	*df.*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Confidence Interval Lower*	*Upper*
Cost	3.32	153.73	.001	1102.28	331.86	446.68	1757.88

Discussion, Conclusions, and Recommendations

The findings in this research study show that at higher educational aviation institutions, it can be significantly cheaper and more time-efficient to complete the Instrument course during Night flight blocks compared to Day flight blocks. The significant results obtained from the *t*-test indicate that students, on average, spend more money to complete the course during the day compared to students who conduct the course at night. The parameters selected for the test were Two-Tail, with an Alpha Level of .05. The power chosen was .8. Several reasons explain these significant results; these will be discussed in the following section.

Discussion

As discussed in previous sections, day and afternoon times are generally peak times for air travel and air traffic control service requests. Having more air traffic not only reduces the capability of ATC to provide services but also increases delays experienced by pilots. With more traffic in the airspace, ATC must increase separation over a wider area, giving pilots more delayed vectors compared to a less busy time of day. More vectoring and reduced services can lead flight students to have incomplete flying lessons or spend more time in the airplane, which increases the overall cost of their training.

Other possible reasons for increased completion costs during the day include extensive ground delays experienced at airports with a high volume of pilot training. Upon the start of each specific flight block, there is an outflux of airplanes from aviation schools, many of which request departures at the same time. These airplanes, along with traffic from other flight schools, airline carriers, business jet traffic, and occasional military aircraft, cause significant delays for airplanes leaving the ramp and reaching the runway for takeoff (Park, 2020).

Turbulence and extensive vigilance required during day flying can also cause delays due to the need to avoid traffic or find suitable locations within the training areas for holding maneuvers or attitude instrument flying patterns. With more airplanes flying in these practice areas surrounding the home airports during the day, training aircraft must fly farther to conduct instrument maneuvers, as well as to practice instrument approaches.

In summary, the situations discussed above demonstrate how many reasons that cause an increase in flight time during the day are less prevalent at night. There is also usually a smaller number of aircraft flying at night, which prevents ATC from becoming saturated due to the volume of traffic. ATC is generally able to provide more radar services at night, allowing training aircraft to be able to practice instrument procedures more efficiently (such as holds and approaches) with fewer overall delays.

Departing from the airport for a flight presents fewer ground delays at night due to the smaller number of operations at an airport at night, allowing training aircraft to spend less time taxiing from the ramp to the runway. Inbound aircraft to the airport also experience fewer delays due to reduced vectoring by ATC, as there is less landing traffic. Furthermore, less turbulence at night, along with less need to fly farther within the practice areas, all contribute to less flight time required to complete the Instrument course at nighttime than during daytime.

Conclusion

A few notable conclusions were obtained from the analyses of the results of this study. The first conclusion is that a specific flight block can have a significant effect on the overall cost of completing the Instrument course. Flying in a night flight block can lead to a less expensive course completion compared to a daytime block. This was evidenced by the significant difference in means from the overall cost to complete the Instrument course during the day compared to completing the course at night.

Another conclusion drawn is that the time of day influences the cost of completing the Instrument course. The more hours of dual-given flight time a student logs, the more money that student will spend to complete the course. The results of this study contribute to the body of knowledge by adding insight into how flight training operations can differ, specifically regarding Instrument training as it relates to completion cost. These results show how student pilots are capable of accomplishing a training course at night with less money and in less time than completing the course during the day.

Nonetheless, a few limitations to this study include the fact that these results are only applicable to institutions that have a large body of students and that assign these students to conduct training in specific flight blocks. These results would not be generalizable to, for example, students of a smaller flight school that does not assign students to a specific block of time to conduct training. Another limitation is that hourly rates among institutions involved could have varied slightly; however, as previously mentioned, the primary focus of this study was the relationship between day and night overall cost, and not necessarily cost difference among different programs or institutions. The weather was also a limitation, as many parts of the country can be severely impacted by long periods of poor flying weather conditions. To minimize this, data from four different semesters was used in this research. Furthermore, there are other factors that were not analyzed in this study, such as the number of days taken to complete the course, that could significantly affect the course completion cost. Another limitation is that the data from only four semesters was used, and while the sample size was beyond what was required per G*Power tests, data from more semesters can provide a more robust test and stronger results.

Recommendations

Flight training is a very complex theme, and many factors can affect how quickly and efficiently student pilots can complete their courses. This research only examined the overall cost of completing the Instrument course. Future research can assess other factors, such as the time to complete the course measured in calendar days, cumulative days, or the amount of simulator or oral time.

Additionally, day and night groups are just one method of dividing the student training population; groups can also be classified through other methods, such as earlier, middle, and late blocks, or each individual flight block can also be assessed separately and compared against each other (for example, four groups [Day, Day, Night, Night] instead of the grouping of the two first groups and the two last groups together).

Other topics that can be assessed in future studies include whether there is any significant relationship between the number of days a student takes to complete the Instrument course and the overall cost of the course. Likewise, another topic for further research could include whether there is any difference in the overall calendar days to complete the Instrument course between day and night, early and late, or individual flight blocks.

Undoubtedly, the most significant recommendation from this study is directed at students of higher educational aviation institutions who just completed their Private Pilot courses and are in the process of signing up for an Instrument flight block. As students have the option to select their own flight blocks based on individual personal preference, the results of this research can supplement these students with information that can be helpful in this decision.

Many times, students must manage other classes, clubs, work, or extracurricular activities along with a flight block, and many of these only have the opportunity to pick a flight block that will not interfere with other scheduling duties. Other factors that might limit the choice of a specific flight block include excessive registration for a specific block, which could lead to a waitlist for that block.

Nonetheless, students who have the opportunity to choose from different blocks and are not affected by a waitlist or other conflicting scheduling assignments can use the results obtained from this research to make a more informed and educated decision on the specific flight block they will sign up for. Having the knowledge of how flight training can be affected by the time of day can also add to the body of knowledge in the literature by demonstrating how flight instruction and training operations can be conducted more efficiently and effectively during different parts of the day.

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