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No juried publication can excel, unless experts in the field serve as anonymous reviewers. Indeed, the ultimate guarantors of quality and appropriateness of scholarly materials for a professional journal are the knowledge, integrity, and thoroughness of those who serve in this capacity. The thoughtful, careful, and timely work of the Editorial Board and each of the following professionals added substantively to the quality of the journal, and made the editor's task much easier. Thanks are extended to each reviewer for performing this critically important work. In addition to the members of the Editorial Board, the other reviewers for this issue include:

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STATEMENT OF OBJECTIVES

The *Collegiate Aviation Review* is published semi-annually by the University Aviation Association. Papers published in this volume were selected from submissions that were subjected to a blind peer review process, for presentation at the 2011 Fall Education Conference of the Association.

The University Aviation Association is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education. Working through its officers, trustees, committees and professional staff, the University Aviation Association plays a vital role in collegiate aviation and in the aviation industry.

The University Aviation Association accomplishes its goals through a number of objectives:

> To encourage and promote the attainment of the highest standards in aviation education at the college level.
>
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>
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Call for Papers

The Collegiate Aviation Review (CAR) is the refereed journal of the University Aviation Association (UAA). Both qualitative and quantitative research manuscripts relevant to aviation are acceptable. The CAR review process incorporates a blind peer review by a panel of individuals who are active in the focus area of each manuscript. Additional recommendations are also provided by the editors of the CAR. A list of all reviewers is published in each edition of the CAR and is available from the CAR editor.

Authors should e-mail their manuscript, in Microsoft Word format, to the editor at CARjournal@uaa.aero no later than June 1 (Fall 2012 issue) or December 1 (Spring 2012 issue).

Previous editions of the CAR should also be consulted for formatting guidance. Manuscripts must conform to the guidelines contained in the Publication Manual of the American Psychological Association, 6th edition. Specifically, this means that submissions should follow the formatting found in the manual, e.g. proper use of the headings, seriation, and in-text citations. The references section must be complete and in proper APA format. Submissions that include tables and figures should use the guidelines outlined in the APA manual. In order to better align the CAR with the general research community, submissions should take into account the recommendations of the APA Task Force on Statistical Inference (see http://www.apa.org/science/leadership/bsa/statistical/tfsi-followup-report.pdf). Papers that do not meet these expectations will be returned to the author for reformatting.

All submissions must be accompanied by a statement that the manuscript has not been previously published and is not under consideration for publication elsewhere. Further, all submissions will be evaluated with plagiarism detection software. Instances of self-plagiarism will be considered the same as traditional plagiarism. Submissions that include plagiarized passages will not be considered for publication.

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Energy Drink Consumption and its Effects on Student Pilots: Perceptions of Collegiate Flight Students

Timm J. Bliss and Chad L. Depperschmidt
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ABSTRACT

During the past ten years, there have only been a few published research studies examining the possible behavioral consequences of energy drink consumption by college students. With that in mind, the authors surveyed collegiate aviation flight students regarding their consumption of energy drinks and their perceptions of side effects and behavioral patterns after consuming energy drinks. Results show that 57% of student pilots surveyed consume energy drinks 1-3 times a week. In addition, 56% stated they can only consume one energy drink (16 ounces) without experiencing side effects. A majority (60%) reported they consumed energy drinks the same day they piloted an aircraft; and the same percentage (60%) had observed other student pilots consuming energy drinks the same day they piloted an aircraft. And yet, 67% of the participating flight students agree that energy drinks have an effect on collegiate flight students' ability to pilot an aircraft.

INTRODUCTION

Inspired by the success of the Red Bull energy drink, which entered the United States market in 1997; more than 1,000 smaller players have also entered the energy drink market (Helm, 2005). As a result, energy drinks have become the fastest selling category in the beverage industry. Since 2001, the market for energy drinks in the United States has increased exponentially. From 2002 to 2005, the consumption of energy drinks increased by 50% each year; in 2006, over 500 new energy drinks were introduced worldwide and total sales equaled $3.2 billion. Sales of energy drink products such as Red Bull, Full Throttle, Nos, and Monster are expected to reach $9 billion in the United States in 2011 (Park, 2011).

A large part of this yearly increase in energy drink consumption is a result of the addictive properties of energy drinks and aggressive advertising campaigns by manufacturers directed toward the college student (Buchanan, 2010). The objective of this marketing strategy is straight-forward; provide college students, who have a harder time resisting immediate gratification, with free samples to get them using the energy drink product. Then, once they are hooked, take full advantage of the stimulating and addictive properties of these drinks (Pohler, 2010).

Energy drinks have no doubt taken off on college campuses, but with newly introduced energy drink products comes the question of whether or not the drinks will have a more lasting effect than a quick energy buzz. What college students may be unaware of is that newer brands of energy drinks such as Spike and Redline, contain up to 4 times the amount of caffeine per ounce, and also contain powerful herbal compounds such as yohimbine hydrochloride (HCL) and evodamine which are far more dangerous stimulants than caffeine (Energyfiend.com, 2010).

In October 2010, Ramapo College forbade their students from consuming energy drinks – the beverage of choice for these students. The energy drink ban comes after the college reported that 23 students were hospitalized for alcohol intoxication at the beginning of the fall 2010 semester. One of the energy drinks banned by Ramapo was Four Loco, an energy drink containing 12% alcohol; the alcohol equivalent of consuming four cans of beer. The manufacturer behind the $3 drink describes Four Loco as a premium caffeinated alcoholic beverage which is available in nine fruity carbonated flavor including cranberry lemonade, lemon lime, and blue raspberry (Keegan, 2010). By the end of November, 2010, several states across the nation had banned the sale of Four Loko following this and many other incidents of drunkenness, illness and hospitalizations on college campuses (Melnick, 2010).

Recent research has indicated that young adults (those under age 25) are more vulnerable to substance use (Miller & Carroll, 2006). This is an important consideration for college students because the earlier they start consuming energy drinks, the greater the likelihood of future psychological problems including addiction, depression and anxiety.

Energy drink use has become widespread among college students and evidence suggests that usage rates could be even higher among special student populations (collegiate flight students) who are under increased cognitive and performance demands (Oteri et al., 2007). However, only a small number of research studies have been conducted to determine energy drink usage among college students. A 2007 study researched approximately 500 United States college students and found that 51% reported drinking at least one energy drink each month during the semester. The reasons for consuming energy drinks were: low energy levels, insufficient sleep, studying, performing a function for an extended period of time, and mixing with alcohol. In addition, the students reported several side effects from consuming energy drinks: headaches, heart palpitations, and jolt and crash episodes (Malinauskas et al., 2007).

In another study conducted in 2008, the researcher examined the relationships between energy drink consumption and risk-taking in 795 undergraduate students. According to the study's findings, frequent energy drink consumers (six or more days a month) were three more times likely than less-frequent energy drink consumers or non-consumers to have smoked cigarettes, abused prescription drugs and been involved in a violent altercation. Energy drink users were also more likely to engage in other forms of risk-taking: unsafe sex, not wearing a seatbelt, participating in extreme sports and doing something dangerous on a dare (University of Buffalo, 2008).

At the time of this study, however; only one identified study (Depperschmidt, Bliss & Woolsey, 2010) researched the effects of energy drinks on collegiate student pilots. The researchers studied the overall effects of energy drink consumption on pilot skills in collegiate flight students in three distinct areas; straight and level flight, complex turns, and in-flight emergencies. This study concluded the following:

- When comparing student pilots' straight and level flight segments, 87% of the pilots had a larger number of point deductions after consuming one energy drink when compared to the pilots consuming a placebo drink.

- When measuring the total amount of time to complete the complex turns, 53% of the student pilots completed the maneuver quicker after consuming an energy drink; however, it took the energy drink participants approximately ten additional seconds to recover from the complex turn and achieve straight and level flight when compared to the placebo participants.

- When measuring the ability of the student pilots to accurately follow a five-step in-flight emergency checklist, participants were less accurate after consuming an energy drink compared to the placebo. Furthermore, it took the energy drink participants an average of 52 seconds to complete the emergency checklist; whereas the placebo participants were able to complete the checklist in lesser time, an average of 47 seconds.

Having obtained these specific research results showing that college flight students became less able to perform routine flight maneuvers or apply what they have learned to unpredicted flight situations after consuming one energy drink, the authors decided to investigate these same flight students' perceptions regarding the effects of energy drink consumption. In addition, the authors were interested in examining the students' demographic information regarding their own energy drink consumption.

RESEARCH METHODOLOGY

The research instrument developed by the authors was administered at Oklahoma State University, a four-year research institution that offers a comprehensive aviation curriculum; awarding bachelor degrees in several aviation disciplines including professional pilot. Exploratory in nature, this study was designed to elicit student information and perceptions related to energy drink consumption and the resulting effects on collegiate flight students.

This research was guided by the following research questions:

1. Do collegiate flight students typically consume energy drinks? If so, do they consume energy drinks the same day they pilot an aircraft?

2. Do collegiate flight students believe energy drinks have an effect on their ability to pilot an aircraft?

3. Do collegiate flight students believe the consumption of energy drinks can be associated with behavioral problems (academic misconduct, violence, risky or dangerous activities)?

Selection of the Research Population

The population for this study was 30 undergraduate aviation students majoring in Professional Pilot at Oklahoma State University and currently enrolled in a flight course for academic credit. These are the same flight students that participated in the 2010 study focusing on the effect of energy drink consumption on collegiate flight students' pilot skills in simulated flight (Depperschmidt, Bliss & Woolsey, 2010). Permission to perform this research study involving collegiate flight students was approved by the Institutional Review Board at Oklahoma State University (IRB application number: ED1017).

Description of Research Instrument

The research instrument for this study was developed to identify demographic information related to collegiate flight students and investigate their perceptions related to energy drink consumption. The instrument consisted of three parts: demographic information, Likert-scale statements, and personal comment section. The first part requested demographic information specific to each collegiate flight student participating in the study. The second part of the research instrument listed Likert-scale statements with ordinal measurement pattern options ranging from: (1) Strongly Agree, (2) Agree, (3) Disagree, and (4) Strongly Disagree. These statements were intended to gain insight into the perceptions of the participating flight student related to energy drink consumption and the effects of these drinks on student pilots. The final part of the instrument consisted of a text box offering the participants an opportunity to provide additional comments they believed would be beneficial to the study.

Validity and Reliability of Research Instrument

Concurrent validity has to do with the correlation between instrument measurement items (Likert-scale) and observed and accepted standard measures. Basically, the authors are determining if proposed measures for a given concept exhibit the same magnitude of correlation with other variables. In a recent study, the authors demonstrated that college flight students became less able to perform routine flight maneuvers or apply what they have learned to unpredicted flight situations after the consumption of one energy drink; providing the argument that the side effects of energy drink consumption reduce performance levels of alertness issues and concentration levels (Depperschmidt, Bliss & Woolsey, 2010). The authors now wish to test this relationship measure further by having these same flight students complete a research instrument; thereby identifying their perceptions of energy drink consumption and side effects after consumption. By comparing the research results of their previous study with the ten Likert-scale statements from this study, the authors will establish concurrent validity with the Likert-scale section of the research instrument.

Face validity is the validity of a test at face value. In other words, a test can be said to have face validity if it “looks like" it is going to measure what it is supposed to measure. To determine face validity, the Likert-scale statements included in the research instrument were examined by five collegiate aviation professionals. After review of the statements, all of the aviation professionals agreed that it looks like a good test to measure student perceptions of energy drink consumption; thereby establishing the face validity of the test.

Furthermore, the Likert-scale statements listed in the research instrument were analyzed for internal reliability by using Cronbach’s alpha. Cronbach’s alpha is a general formula for estimating internal consistency based on a determination of how all items on a test to all other items and to the total test (Gay, Mills, & Airasian, 2006). George and Mallery (2003) have established the following Cronbach’s alpha acceptance scale: “ - > .9 – Excellent, - > .8 – Good, - > .7 – Acceptable, - > .6 – Questionable, - > .5 – Poor, and - < .5 – Unacceptable” (p. 231). For this study, the authors entered all data into a Microsoft Excel spreadsheet and exported it into SPSS version 17.0 for analysis. Cronbach’s alpha analysis resulted in a coefficient alpha reliability score of .717, an acceptable level of internal reliability.

RESULTS

Each participating collegiate flight student was asked to identify their academic classification. Table 1 indicates that of the 30 respondents; 7% were freshman, 17% were sophomores, 43% were juniors, and 33% were seniors. The gender of the flight students was also solicited in this study. Eighty-three percent of the flight students were male and 17% were female students.

Table 1. *Academic Classification of Collegiate Flight Students*

Academic Classification	Respondents	Percentage of Respondents
Freshman	2	7%
Sophomore	5	17%
Junior	13	43%
Senior	10	33%

In Table 2, flight hours amassed by each responding collegiate flight student were separated into six sub groups: 25-49; 50-99; 100-149; 150-199; 200-249; and 250 and over. Approximately half (53%) of the participants had accumulated 25-149 flight hours; whereas, the other half of total respondents (47%) indicated they had over 150 flight hours.

Table 2. *Total Flight Hours of Collegiate Flight Students*

Total Flight Hours	Respondents	Percentage of Respondents
25-49	2	7%
50-99	7	23%
100-149	7	23%
150-199	5	17%
200-249	1	3%
250 & over	8	27%

Table 3 indicates how often each collegiate flight student typically consumes energy drinks. The majority of respondents (57%) indicated they consume an energy drink 1-3 times a week. Forty percent of these flight students stated they typically do not consume energy drinks.

Table 3. *Consumption of Energy Drinks*

Energy Drink Consumption	Respondents	Percentage of Respondents
0 per week	12	40%
1-3 per week	17	57%
4-6 per week	1	3%
7-9 per week	0	0%
10 or more per week	0	0%

Of the 18 students (60%) who typically consume energy drinks (Table 3), they were asked to respond to a question indicating how many 16-ounce energy drinks they can consume daily without experiencing side effects (jolt and crash episodes, headaches, heart palpitations, etc.). These students' responses are presented in Table 4. The majority of the students (56%) responded they only have to consume one energy drink to experience side effects. A 2007 study at Wayne State University found that blood pressure and heart rates did in fact increase in healthy adults who drank two cans of energy drink in a given day (American Heart Association, 2007).

Table 4. *Consumption of Energy Drinks without Experiencing Side Effects*

Energy Drink Consumption	Respondents	Percentage of Respondents
1	10	56%
2	7	39%
3	1	5%
4	0	0%
More than 4	0	0%

The reasons collegiate flight students consume energy drinks are presented in Table 5. A higher number of responses, 75, were received from the flight students because the survey question asked the students to "check all that apply" regarding the reasons they consume energy drinks. The three most common reasons the students consumed energy drinks were: needing more energy (23%), driving an automobile for a long period of time (20%), and studying for an exam/completing homework (17%). Those who chose the option of other had the opportunity to identify their reasons for consuming energy drinks; three students indicated they liked the taste, two indicated they consumed energy drinks while at work, and one student responded they do not consume energy drinks.

Table 5. *Reasons to Consume Energy Drinks*

Reasons for Energy Drink Consumption	Responses	Percentage of Responses
Need More Energy (in general)	17	23%
Driving Automobile (extended period)	15	20%
Study for Exam/Complete Homework	14	17%
Sleep Deprivation	11	15%
Mix with Alcohol (partying)	8	11%
Other	8	11%
Piloting Aircraft (extended period)	2	3%
Peer/Societal Pressure	0	0%

As indicated in Table 6, the majority (60%) of surveyed collegiate flight students indicated they have consumed an energy drink the same day they piloted an aircraft. Since 18 of the 30 participating students (60%) indicated they consumed at least one energy drink on a weekly basis (Table 3), these same 18 students are responsible for consuming an energy drink on the same day they piloted an aircraft. Furthermore, 60% of the students indicated they have seen other student pilots consuming energy drinks the same day these students have piloted an aircraft.

Table 6. *Consumption of Energy Drink Same Day Piloted an Aircraft*

Energy Drink Consumption	Respondents	Percentage of Respondents
Yes	18	60%
No	12	40%

Likert-scale statements that examine the collegiate flight student's perceptions regarding energy drinks and energy drink effects are presented in Table 7. Seventy percent of the respondents agreed, compared with 30 percent that disagreed with the statement: *Consumption of energy drinks is considered similar to consumption of coffee*. Over half of respondents (57%) agreed with the statement: *Jolt and crash (no/low energy) episodes are typical after consumption of energy drinks*. The remaining 43% disagreed with the statement. One flight student wrote on their survey, "Although consumption of energy drinks does give me some energy, I find the biggest concerns comes 2-4 hours after consumption. Although I will be fatigued after the 'crash' I will still be unable to sleep."

Approximately two-thirds of the flight students (63%) indicated they agreed; opposed to 37% that disagreed with the statement: *Heart palpitations (pounding or racing) are common after consuming energy drinks*. However, only about one-fourth of the students (27%) agreed that headaches are common after consuming energy drinks.

Even though 53% of collegiate flight students disagreed with the statement: *Chronic use of energy drinks can lead to other use of stimulants (Adderall, Ritalin, etc.)*, the remaining 47% of responding students agreed that chronic energy drink consumption can lead to other use of stimulants. But surprisingly, only 13% of student pilots agreed with the statement: *The consumption of energy drinks can be associated with risky or behavior problems (academic misconduct, doing something dangerous on a dare, interpersonal violence, etc.).*

Table 7. *Collegiate Flight Students' Perception of Energy Drinks Regarding Side Effects*

Likert-Scale Statements	SA	A	D	SD
Consumption of energy drinks is considered similar to consumption of coffee.	3 10%	18 60%	8 27%	1 3%
Jolt and crash (no/low energy) episodes are typical after consumption of energy drinks.	2 7%	15 50%	12 40%	1 3%
Headaches are common after consuming energy drinks.	1 3%	7 24%	18 60%	4 13%
Heart palpitations (pounding or racing) are common after consuming energy drinks.	1 3%	18 60%	11 37%	0 0%
Energy drinks have no effect on short term memory.	1 3%	16 54%	13 43%	0 0%
Chronic use of energy drinks can lead to other use of stimulants (Adderall, Ritalin, etc.).	2 7%	12 40%	12 40%	4 13%
The consumption of energy drinks can be associated with risky or behavior problems (academic misconduct, doing something dangerous on a dare, interpersonal violence, etc.).	1 3%	3 10%	19 63%	7 24%

(SA) – Strongly Agree, (A) – Agree, (D) – Disagree, (SD) – Strongly Disagree.

Responding to the Likert-scale statement in Table 8, *Energy drinks have an effect on collegiate flight students' ability to pilot an aircraft*, two-thirds of the student pilots agreed that energy drinks have an effect on flight students' ability to pilot an aircraft. The remaining 34% disagreed that energy drinks affected flight students' ability to pilot an aircraft.

Almost 75% of flight students disagreed with the statement: *Energy drinks are an effective and safe method to increase a collegiate flight student's mental and physical performance*, with one of the flight students stating on their survey; "I agree with the fact of energy drinks not affecting flying in a negative manner up to a point. I do believe that if you pound 3 energy drinks down within a short amount of time, there will be negative effects." And yet, 90% of the respondents perceived it was okay for collegiate flight students to consume an energy drink the same day they piloted an aircraft.

Table 8. *Collegiate Flight Students' Perception of Energy Drinks Regarding Flight Students*

Likert-Scale Statements	SA	A	D	SD
Energy drinks have an effect on collegiate flight students' ability to pilot an aircraft.	0 0%	20 66%	8 27%	2 7%
Energy drinks are an effective and safe method to increase a collegiate flight student's mental and physical performance.	0 0%	8 27%	19 63%	3 10%
Collegiate flight students should not consume an energy drink the same day they operate an aircraft.	0 0%	3 10%	22 73%	5 17%

(SA) – Strongly Agree, (A) – Agree, (D) – Disagree, (SD) – Strongly Disagree

CONCLUSIONS

College students have busy schedules and can be under a great amount of stress. One way students are combating this problem is by consuming energy drinks to get that much needed boost of energy. As a result, college students are relying on energy drinks more than ever. And it is no wonder. If college students are in need of a quick pick me up, they are drawn to names that promise vigor, like Full Throttle, Amp, or Rush (Better Medicine, 2011). As a result, college students are huge consumers and are highly targeted by these energy drink companies.

This research study sought to identify the existence of energy drink consumption among collegiate flight students at Oklahoma State University and their perceptions regarding the effects of energy drink consumption on their ability to pilot an aircraft. With a better understanding of collegiate flight students' perceptions of energy drink consumptions and their reasons for energy drink consumption; additional education programs can be implemented by aviation departments regarding the risks associated with energy drink consumption, as well as policies that discourage or even eliminate energy drink use among collegiate flight students - especially on those days that students pilot an aircraft.

Indicative of the data collected from this research study, the majority of participating collegiate flight students believed that energy drinks have an effect on their ability to pilot an aircraft. In addition, the majority of respondents indicated that heart palpitations, as well as jolt and crash episodes are common after consuming energy drinks. Furthermore, 56% of the flight students responded they only have to consume one energy drink to experience these mentioned side effects. And yet, profoundly, 90% of the flight students disagreed with the statement that collegiate flight students should not consume an energy drink the same day they pilot an aircraft. An interesting fact is that 70% of these flight students responding to the research survey have over 100 total flight hours; and twenty-seven percent of these students have accumulated 250 or more total flight hours; indicating that the majority of the participating students are upperclassmen and have been associated with the collegiate flight program for at least two to three academic years.

Even though research studies have linked energy drink consumption to risk-taking behaviors among college students, an overwhelming 87% of the flight students disagreed that energy drink consumption can be associated with risk-taking or behavior problems. In addition, it was about a 50/50 split among respondents that the chronic use of energy drinks can lead to other use of stimulants including Adderall and Ritalin; even though a 2010 study found that energy drink users were significantly more likely to initiate nonmedical use of prescription stimulants (Arria, et al, 2010).

Given that the energy drink market in the United States has increased by over 75% in 2010, and the non-energy carbonated drink market has actually declined for the first time in 20 years, it is evident more and more people are consuming these beverages, which raises questions for college students who consume energy drinks (Pearson, 2010). Mostly, college students consume energy drinks in the afternoon; but now, a higher percentage of them are being consumed in the evenings with alcohol. A 2011 research study indicates that college students who have a high frequency of energy drink consumption (one energy drink per week) were at a significantly higher risk of alcohol dependence and episodes of heavy drinking (Arria et al., 2011).

With an increasing number of energy drink varieties introduced each year, the choices are virtually endless. Furthermore, the differences in caffeine and other stimulant levels among energy drink brands are as numerous. The consumer may assume that two similar-sized energy drinks would deliver the same amount of stimulant effect; however, one of the drinks can contain more than 300% more caffeine than the other (Energyfiend.com, 2010). In addition to a huge variance in caffeine and other stimulant levels, energy drinks like Four Loco now contain high percentages of alcohol. These readily available energy drinks containing various levels of stimulants and alcohol can easily pose a significant threat to college students who consume them but are not familiar with the drink's contents, as they are not all created equal. This is especially concerning when energy drink consumption is prevalent within the collegiate flight environment.

Due to the increase in prominence of energy drink consumption on college campuses, the various levels of energy drink ingredients, their physical and cognitive effects on students, and the established perception of collegiate flight respondents from this study; the collegiate aviation community should be aware and cautious of the negative effects of energy drink consumption in the collegiate flight environment.

Even though there were a few limitations associated with this study: (1) the number of participants during the data collection phase of this project was relatively small; therefore, the generalization of findings may be somewhat limited, (2) homogeneity, this study only included collegiate flight students at one university; if flight students from other collegiate flight programs also completed the research instrument, the results might be different, and (3) the participants' inability to be 100% reliable in their survey responses - the results provide a foundation for future research regarding collegiate flight students' responses and perceptions of energy drink consumption and the potential effects that consuming energy drinks may have on piloting aircraft.

Future research should be done by collegiate aviation to examine the consumption of energy drinks by collegiate flight students. First of all, a much larger student population (national study) needs to be researched to fully understand the effects that energy drink consumption has on collegiate flight students; as well as their consumption characteristics (when, why, and how often). Furthermore, additional simulated flight studies should be performed to determine additional effects that energy drink consumption may have on the cockpit performance of collegiate flight students; in an effort to minimize the daily risks associated with collegiate flight students piloting an aircraft. Lastly, the perceptions of collegiate flight program administrators should be researched to better understand their knowledge and thoughts regarding the consumption of energy drinks by their own flight students.

In short, careful and continued consideration should be given to energy drink consumption on college campuses and the perception of collegiate flight students regarding the consumption of energy drinks. Hopefully the ultimate lesson to be learned by students is that when it comes to obtaining energy, look elsewhere than an energy drink. Sure, college students can temporarily increase their energy level with energy drinks, but as documented and researched, they are bound to crash.

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Fleet Characteristics of Collegiate Aviation Flight Programs

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ABSTRACT

The University Aviation Association (1991) completed the last report on the status of collegiate aviation programs over two decades ago. The purpose of the current report is to update the field regarding the status of collegiate aviation fleet characteristics. Using existing survey data, collected in 2010 from 38 collegiate aviation programs in the United States that use aircraft or flight-training devices (FTD), fleet size, hours in use, aircraft and FTD types used, and the number of students in each program were investigated. The results indicate that collegiate aviation flight programs have increased their number of aircraft and FTD since the 1991 study.

INTRODUCTION

Over the last 20 years, multiple changes to collegiate aviation programs have occurred. The aircraft fleet size, diversity of aircraft used in training, student population, and cost all have been variable factors in training future airline pilots (Depperschmidt, 2008; Karp, 1996; Karp et al., 2001; University Aviation Association, 1991). While a variety of aircraft are utilized to train pilots, many descriptive characteristics of collegiate aviation fleets are unknown. This study will describe the current fleet of training aircraft used in collegiate aviation. The background, type, and size will be examined in conjunction with a literature review of past research into fleet characteristics in collegiate aviation.

Preexisting data from April of 2010 is used in an attempt to discover the needs and wants of collegiate aviation programs that offer flight training. The importance of this study is to create some guidance for new students looking at collegiate aviation programs as well as program administrators comparing aviation programs' strengths and weaknesses. Additionally, this article describes data that is of interest to aircraft manufacturers, flight schools, and individuals making decisions regarding proposed legislation.

REVIEW OF LITERATURE

As an industry, scholars and practitioners have a limited understanding of various fleet characteristics. One major issue with current collegiate aviation programs is the lack of data regarding how many training aircraft and flight-training devices are used to train professional pilots. Another issue related to fleet characteristics is the average age of training aircraft, the amount of hours that each airplane flies per year, and how the ownership characteristics of the flight training aircraft affect the flight program. All of which are useful for administrators to understand. In this study, we present data from a survey that investigated the fleet characteristics of two- and four-year collegiate aviation programs.

In 1991, the University Aviation Association undertook a national survey of collegiate aviation programs in the United States that used aircraft and flight-training devices (FTD) in their curriculum. The findings of the study, despite being over twenty years old, identify the status of the fleet of aircraft used in collegiate aviation programs at the time. This study found that 58% (N = 119, M = 13) of all schools operating aircraft used between 1 and 10 aircraft and 48% of the flight schools operated between 1 and 5 FTD. Since 1991, no other study has looked specifically at the descriptive statistics of the aviation programs offering flight training at the collegiate level.

The Federal Aviation Administration (FAA) tracks the number of aircraft certified for specific use each year. The data shown in Table 1 for 2009 indicates the percentage of general aviation flying that was instructional (Federal Aviation Administration, 2009b).

Table 1. *2009 General Aviation and Air Taxi Number of Active Aircraft by Primary Use*

Aircraft Type	Total Active	Instructional	Percentage
Fixed Wing: Total	177,446	12,061	6.8%
Piston: Total	157,123	11,912	7.6%
1 Engine: Total	140,649	10,986	7.8%
2 Engine: Total	16,474	926	5.6%

Note. Adapted from the (Federal Aviation Administration, 2009b)

According to the FAA Aerospace Forecast (2010), "the active general aviation fleet is estimated to have increased 0.1 percent in 2010 from 223,948 to 224,172. With the increase in the active fleet, general aviation flight hours are estimated to have increased 1.2 percent in 2010 to 24.1 million" (p. 25). This equates to approximately 107.5 hours per aircraft annually. In comparison, the average hours flown by commercial U.S. air carrier operators is 8.26 hours per day, or 3,015 hours annually (Darby, 2008, p. 24).

The average number of pilots per aircraft is another important consideration in both collegiate training programs and other sectors of the aviation industry. Darby (2008), presenting at the 33rd Annual FAA Forecast Conference in Washington, D.C. on the future of U.S. airline pilots, stated that there was an industry average of 9.63 pilots per aircraft. Lovelace and Higgins (2010) reported that the average for legacy and major carriers is 12.65 per aircraft. According to the FAA (2009a), there were 594,285 active pilots in the U.S. and 223,920 total aircraft (Federal Aviation Administration, 2010) for an average of 2.65 pilots per general aviation aircraft. Neither the commercial nor the general aviation statistics are appropriate in addressing the collegiate aviation training fleet because the mission is very different for each fleet of aircraft. Understanding the proper ratio of pilots to training aircraft in collegiate aviation will allow for better utilization, lower operating costs, and maximum profit for each program.

Another important aspect of collegiate aviation is fleet management. According to Christensen and Thorpe (2009), in their report on ground based fleet management, one of the purposes of introducing fleet management is to "create the most lean, cost-effective, efficient, and environmentally sustainable fleet policies, procedures, and operations possible" (p. 19). Administrations can benefit from understanding what other flight programs are doing in order to predict fleet operation size with regard to student enrollment numbers. The commercial airlines predict that, for every aircraft brought into service, a certain number of pilots are needed to manage those aircraft. Furthermore, Boeing (2011) predicted that 466,650 trained pilots are needed to properly staff the world's airlines over the next 20 years. However, collegiate aviation does not have any studies that specifically address how they will meet the need of the pilot shortage or manage the collegiate fleet size to train future aviators.

While many statistics have described the size and scope of the general aviation fleet and the airline fleet, few specifically have targeted collegiate aviation. The number of general aviation aircraft is up, as are flight hours, but no recent data exists describing the collegiate aviation training fleet (Federal Aviation Administration, 2010). Brown Aviation Lease conducted a study in March of 2010 to answer some of the lingering questions regarding the makeup of the collegiate aviation training fleet (both aircraft and FTD).

Thus, the purpose of the current study was to determine the number of aircraft and flight-training devices of collegiate aviation flight programs in the United States and to update the profession regarding collegiate flight training programs.

The survey was used to assist in answering the following research questions:

1. What is the aircraft fleet size of collegiate aviation programs?
2. What type of flight simulation is used in collegiate aviation?
3. What is the age and flight hours per year of the aircraft used by collegiate aviation programs?
4. What type of aircraft is used in flight training?
5. What is the rate per hour students pay for aircraft?
6. How many students does the average collegiate flight school have?

METHODOLOGY

Data and Recruitment

In the spring of 2010, Brown Aviation Lease conducted a survey of collegiate aviation programs in the United States listed in the University Aviation Association (UAA) *Collegiate Aviation Guide*. This guide lists all two- and four-year public and private higher education schools that are members of the University Aviation Association. While this list of aviation schools may not include all collegiate aviation programs, other scholars in the field that study collegiate aviation programs (e.g., Ison, 2008; Ruiz, 2004) have used this selection procedure.

The preexisting data used in this paper was gathered by Brown Aviation Lease by sending out emails to 98 aviation program chairs or departmental leaders describing the online survey and inviting participation in the study. The participants followed a link to a secure Web site operated by the marketing firm Constant Contact. A month after initial contact, telephone reminders were made to institutions that had not yet completed the survey. Thirty-eight of the 98 programs listed in the *Collegiate Aviation Guide* responded to these requests (response rate of 38.8%); however, only 31 programs that responded operate a fleet of aircraft. Thus, the total response rate for this study is 31 collegiate aviation programs.

Analytic Strategy

Data were input into SPSS and checked against the actual surveys. Because the data was preexisting in categorical form, this paper only addresses the research questions by reporting the number of responses and percentages. Comparative data was not collected as part of this research project.

RESULTS

To identify the number of aircraft used in flight programs, participants responded to the survey question, "How many primary training aircraft do you operate?" Possible categorical responses to this question were 0 to 4, 5 to 9, 10 to 19, and more than 20 aircraft. Of the 31 flight schools surveyed, all indicated that they operated five or more aircraft. Fifteen programs operated 5-9 aircraft, and more than half of the programs operated 10 or more aircraft. The responses to this question are found in Table 2.

Table 2. *Number of Primary Aircraft per Flight School*

Number of Aircraft	Schools	Percentage
0-4	0	0%
5-9	15	48.4%
10-19	11	35.5%
> 20	5	16.1%

To determine the type of flight simulation utilized in collegiate aviation programs, the participants were asked, “Do you utilize simulation equipment and, if so, what type of equipment?” The majority of flight schools (n = 27) used flight-training devices. The least frequently used type of simulation was full-motion simulators (n = 2). Thirteen collegiate aviation programs used only one type of simulation, 14 programs utilized two types of simulation, and two programs reported using three different types of simulation. Table 3 indicates the type of flight simulation used.

Table 3. *Type of Simulation Utilized in Flight Schools*

Type of Simulation Equipment	Schools
PC ATD	14
AATD	18
FTD	27
Full Motion Simulator	2

Note. Flight programs could indicate more than one response to this question.

In Table 4, the average age and flight hours per year on aircraft used by collegiate aviation programs was calculated. According to the survey, the mode age of their primary aircraft was 5-9 years old.

Table 4. *Average age of primary training aircraft*

Aircraft age in years	Response	Percentage
0-4	5	16%
5-9	12	38%
10-19	6	19%
>20	9	29%

Note. Percentages do not add up to 100% due to rounding

The total number of hours used per aircraft is important when planning for future upgrades to fleet size or maintenance schedules. Of the schools reporting annual usage (N = 31), over 90% used their aircraft between 200-799 hours annually. Table 5 shows the number of flight hours per year for primary training aircraft.

Table 5. *Annual number of flight hours per primary training aircraft*

Number of flight hours	Number of responses	Percentage
0-199	1	3%
200 - 399	12	38%
400 - 799	16	52%
>800	2	6%

Note. Percentages do not add up to 100% due to rounding.

The most common manufacturer of aircraft used as a primary trainer in collegiate aviation flight training programs is Cessna Aircraft (n = 21), followed by Piper Aircraft (n = 7). Aircraft listed in the "Other" category in Table 6 that are used as primary trainers in flight programs included the Beech Sundowner, Cessna 172RG, Diamond DA-40, Liberty XLS, Piper Archer, Piper Seminole, Piper Arrow, and Maule aircraft.

Table 6. *Primary Training Aircraft*

Aircraft	Response	Percentage
Cessna 152	6	14.0%
Cessna 172	15	34.9%
Piper Warrior	7	16.3%
Cirrus SR20	3	7.0%
Diamond DA20	2	4.7%
Other	10	23.3%

Note. Percentages do not add up to 100% due to rounding.

In Table 7, the average cost to the student for a primary training aircraft per hour is listed. The cost per hour is for a primary training aircraft with fuel and no instructor.

Table 7. *Estimated hourly rate of primary training aircraft*

Cost	Number of responses	Percentage
$0-99	6	20.0%
$100-134	13	43.3%
$135-159	9	30.0%
160-184	2	6.7%

To provide some demographics of the respondents of the survey, Table 8 displays the number of students in each flight program. According to the results, most collegiate aviation programs have between 50 and 149 students enrolled. Only three schools indicated an enrollment greater than 200 students. The preexisting data does not specify the exact number of students beyond 200.

Table 8. *Number of students per flight school*

Number of students	Number of responses	Percentage
0-49	5	16.1%
50-99	11	35.5%
100-149	10	32.3%
150-199	2	6.5%
> 200	3	9.6%

DISCUSSION AND CONCLUSIONS

While the data from this survey was preexisting, it did provide some descriptive differences between the UAA 1991 report and current data. It appears from the data collected by this survey that 83.8% of flight schools now operate between 5-15 aircraft signifying that each school has increased in size to accommodate a larger student body. From this survey, 89% of programs reported using some type of simulation in their flight program, a sharp increase from the 48% of schools that reported using simulation in the 1991 UAA report demonstrating that simulation is used more frequently to train students in collegiate aviation programs.

The mode age of aircraft used by collegiate flight programs is from five to nine years old and of the schools reporting annual usage (n = 31), over 90% used their aircraft between 200-799 hours. The most prevalent aircraft manufacturer is still Cessna (n = 21) followed by Piper (n = 7). The 1991 UAA report stated that Cessna manufactured 65% of training aircraft, indicating a diversification of aircraft within the collegiate aviation environment.

The last part of the results of this section deal with the size of the flight programs and the cost associated with flight training. According to the survey, the mode (n = 13) for the cost per flight hour is between $100-$134 per flight hour. The UAA 1991 report did not address the per hour cost of flight training, only the aggregate cost of each rating with a median cost. The size of collegiate programs ranged from zero to over 200 with more than 67% of the schools reporting sizes between 50 and 149 students. The UAA (1991) report did not specify the number of students in each flight program. The existing data did not allow for further analysis based on school size.

Every flight program deals with fleet management issues with aircraft. Understanding how many hours each aircraft operates as well as the cost structure associated with each aircraft helps to set standards, differentiate themselves from the competition, and potentially help prospective students choose a school.

RECOMMENDATIONS

The findings of this study help to illustrate some of the fleet characteristics of collegiate flight programs. While this is by no means a comprehensive study, it does shed some light on areas where more research is needed to properly identify information such as average usage hours of aircraft and simulators, ratio of students to aircraft, average cost of aircraft and FTDs, and size of programs involved in collegiate aviation training. This information would be important to government, industry, and education to identify training capacity and cost of collegiate aviation training, which would be useful in times of pilot shortages.

The nature of the preexisting data used in this study did not allow for strong structural analysis. The disadvantage of this study is it does not allow the researcher to quantify many of the results because large schools (>20 aircraft and/or >200 students) could have exactly 20 aircraft or 200 aircraft with no way of knowing. Therefore, the results of this study are limited in nature and serve as one leg of a triangulation study addressing all of the fleet characteristics of collegiate aviation.

Based upon these observations, more research is needed to address issues in collegiate aviation, including creating a more robust national survey to identify more specific fleet characteristics. Identifying what aircraft and FTD are being used to fulfill advanced ratings requirements such as complex, high-performance, acrobatic, tail wheel, turbine, helicopter, and seaplane flying would be useful. Because some advanced aircraft can be used as primary trainers, this study is limited in its scope but still provides details updating the results of the UAA (1991) national survey of collegiate aviation programs in the United States.

This survey has helped to shed light on some of the operational challenges that are facing the collegiate flight training industry. From the limited data, it appears that some collegiate aviation programs utilize aircraft at a greater rate than others do, with no justification as to why or how they do it; this would be an excellent opportunity for additional research. As a small segment of the aviation environment, collegiate aviation programs can band together to address the pilot training issues by understanding how other programs operate.

As reported the average hour increase in utilization of collegiate aviation aircraft is still unknown, while other sectors of the aviation industry have readily available information on utilization of aircraft. This information would be useful for both practitioners and researchers to understand how utilization changes costs for students, aircraft availability, and hours flown per year.

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A Contrast of Ethical Attitudes and Practices between Aviation Students at Schools With and Without an Ethics Course for Pilots

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ABSTRACT

The authors explore academic and ethical misconduct in various forms and consider the role of students' perceptions. They gather data from professional pilot students in four year academic disciplines from seven accredited universities across the United States. Four components are considered to better understand the behavior and perception of students' conduct in professional pilot education across the United States. These components are: attitude towards academic dishonesty, attitude towards neutralization behavior, attitude towards normalization of deviance, and ethical standards. Preliminary findings from the students' pre-tests are reported.

INTRODUCTION

Academic dishonesty among college students, reported to be at an all-time high, is a major concern of faculty members who teach aviation education. This type of student behavior is of particular interest since students' ethical behavior in college has been found to predict their ethical actions once in the workforce (Oderman, 2002). Oderman (2002) concluded in his study that ethics is an issue of concern in the aviation education community. Although many aviation accidents and problematic incidents can be attributed in whole or in part to unethical behavior or decision-making in some phase of the flight, most colleges and universities in the United States with a professional pilot program do not teach their students a formal ethics course. Ethics training has not been included as a structured part of most pilot aviation programs in higher education institutions. Professional pilot training is one of the largest areas of aviation education, but seems to have the least emphasis on structured ethical training for professional pilot students (Northam & Diels, 2007). This study investigated professional pilot students' ethical behavior and their perception of ethics, academic misconduct, and ethical decision-making in the cockpit.

The public has the right to expect ethical behavior from aviation professionals, a behavior that will ensure the safety of their customers. This expectation is known as the Duty-of-Care, an implicit expectation of the public from companies offering public services. However, examples of unethical behavior from individuals and organizations are all too common. In April 2009, the Federal Aviation Administration (FAA) announced that Southwest Airlines had agreed to pay $7.5M in fines for flying 46 aircraft on 59,791 flights without performing compulsory inspections for fuselage cracks. The aircraft, all Boeing 737s, carried an estimated 145,000 passengers without this important inspection ("Southwest to Pay," 2009). In August 2008, the FAA charged American Airlines for deferred maintenance and other maintenance violations. The fine was $7.1M in civil penalties against the airline for improperly deferring maintenance on related equipment and deficiencies with its drug and alcohol testing programs and exit lighting inspections (Federal Aviation Administration, 2008).

America West Flight 556 was a regularly scheduled flight from Miami, Florida, to Phoenix, Arizona, operated by America West Airlines. On July 1, 2002, the plane was ordered back to the terminal after the pilots were suspected of being legally drunk. The pilots were ultimately convicted of operating an aircraft while intoxicated.

A former airline pilot was found guilty of flying under the influence of alcohol when he was second-in-command of a United Express flight. U.S. District Judge John Tunheim pronounced Aaron Cope guilty in a 15-page decision issued after a non-jury trial in Denver. Cope, 32, of Norfolk, Virginia, was co-pilot on the December 2009 flight from Austin to Denver of a regional jet with a 70-passenger capacity. "The court finds the evidence overwhelming that Cope was under the influence of alcohol during the flight," Tunheim wrote in the decisión (Boczkiewicz, 2011).

SIGNIFICANCE OF THE STUDY

A formal ethics course in the professional pilot curriculum may be a form of intervention in the process of changing students' behavior once in the workforce. Additionally, presenting an understanding as to what drives professional pilot students to violate federal aviation regulations will give aviation faculty an advantage to work toward the behavior modification of students. The result of this study may help aviation educators get a better understanding about aviation students' ethical behavior and their affinity to violate federal aviation regulations. With this understanding, faculties and department heads will be in a better position to update their curriculum and to implement formal courses of ethics.

Research Question

How do student pilots in higher education institutions, with and without formal ethics courses, describe their *ethical standards, academic dishonesty, neutralization behavior, and normalization of deviance?*

LITERATURE REVIEW

The increase in academic dishonesty in the classroom gained interest in the last several years with one specific study that demonstrated an increase of academic dishonesty among college students (Haines, Diekhoff, LaBoff, and Clark, 1986). Haines, et al., 1986, suggested that the literature on college dishonesty and cheating can be divided in two groups: those that study student personal characteristics which are predictive of higher level of academic dishonesty and those which analyze the situations or contextual factors that could lead to increased levels of academic dishonesty in different situations.

Leming (1980) concluded that "cheating behavior is a complex psychological, social, and situational phenomenon" (Leming, 1980, p.86). The Leming study was designed to relate cheating behavior to situational conditions and not to personal characteristics. The cheating was measured using the Hartshorne and May (1928) circle test, which does not bear a relationship to academic activities. This test was used to diminish the likelihood that anticipated academic success would be a factor in the students' cheating behavior. The test was administered under low risk and high risk conditions: a student could cheat by manipulating his/her own scores without the risk of detection (low risk situation), or a student could cheat under controlled conditions where no manipulation of the test scores would be possible without cheating being detected (high risk situation). This study revealed evidence that cheating is situation specific and the sanction of threats and high risk of detection can reduce the incidence of cheating.

The objective of Haines, Diekhoff, LaBoff, and Clark, (1986) in their study was to describe the incidence of cheating and further document its existence, to examine the occurrence of cheating from within the framework of Sykes and Matza's (1957) neutralization theory, to identify demographic as well as personal characteristics of students who cheat, and to search for the fundamental factors underlying cheating behavior. A 49 item survey was administered to 380 undergraduate students at a small southwest state university with a student population of 4,950. Eighty percent of the sample was overrepresented by freshmen and sophomore students. The survey contained items on demographic characteristics, incidence of cheating on major exams, quizzes, and class assignments, perceptions of and attitudes toward cheating by peers, and 11 items on a neutralization scale. The results showed that 54 percent of students reported cheating and only 1.3 percent reported ever been caught. This 1.3 percent can be related to Leming's (1980) study suggesting that a low risk condition existed. Demographic analysis demonstrated that cheaters tended to be younger, single, to have low GPA, and to be receiving financial support from sources other than self supporting. However, no significant differences were found in relation to gender or academic classification. Age showed to be the most significant correlation with cheating in all cheating categories, while lower GPA was second and lastly financial support. "When considered together, these variables can be used as a rough indication of the maturity and commitment to academics on the part of the student" (Leming, 1980, p. 350).

Haines, Diekhoff, LaBoff, and Clark (1986), found that neutralization is fundamental to cheating and can be best labeled as a common denominator in the cheating activities of students. A factor analysis of variables related to cheating was conducted, finding that 28.3 percent of the variance was represented by age, marital status, students' dependence upon parental financial support, and employment status. Haines, Diekhoff, LaBoff, and Clark (1986) concluded that students' immaturity, lack of commitment to academics, and lack of investment in their educations are among the underlying factors that affect students' academic dishonesty.

The McCabe and Travino (1997) study investigated both theories, Leming (1980) and Haines, Diekhoff, LaBoff, and Clark, (1986). This study was a multi-campus investigation on the individual and contextual construct. McCabe and Travino believed that the individual differences are that students have different predisposition to cheat. The study examined the relationship between academic dishonesty and age, gender, academic achievement, parents' education, and participation in extracurricular activities to demonstrate individual characteristics that can predict academic dishonesty. The major objective of this study was "to gain a comprehensive understanding of the relative effects on individual difference and contextual influences on academic dishonesty" (p. 385). McCabe and Travino were convinced, according to the studies of Bowers (1964) and McCabe and Travino (1993) that contextual factors had a strong influence on students' academic dishonesty and they believed these contextual factors, rather than individual differences, would have a greater influence on academic dishonesty.

One thousand seven hundred and ninety three students were surveyed, of which 65 percent were females. After the analysis of the data McCabe and Travino concluded that the findings supported the notion that academic dishonesty is affected by a variety of individual and contextual factors and are consistent with previous research (Bowers, 1964; McCabe and Trevino, 1993). The most powerful influential factors were peer related contextual factors. Twenty seven percent of the variance was accredited to contextual factors in self-reporting cheating when these variables were entered first into the hierarchical regression. However, even when the individual differences were entered first, a large portion of the variance was explained by the contextual variables. "Individual difference variables explained 9 percent while contextual variables explained 21 percent of the variance" (p. 391). From all the contextual variables, fraternity/sorority membership, peer behavior, and peer disapproval had the strongest impact in academic dishonesty.

One can suggest that academic dishonesty can be substantially reduced by implementing an honor code, as suggested by McCabe and Travino (1993). "The most important question to ask concerning academic dishonesty may be how an institution can create an environment where academic dishonesty is socially unacceptable, that is, where institutional expectations are clearly understood and where students perceive that their peers are adhering to these expectations" (McCabe and Travino, 1993, p. 534). McCabe and Travino (1993) studied the implementation of an honor code in institutions of higher education. The honor code is a system that transfers the responsibility of academic integrity from faculty and administrators to students. This process is accomplished by students taking ownership of such a code and consequently deeming academic dishonesty unacceptable by peers. McCabe and Travino's (1993) study was largely based on the social learning theory of Bandura (1986) suggesting that a large portion of human behavior would be learned by influence of example. Based on observation of a credible other, individuals will learn and change their behavior. In this case credible other means peer.

Academic dishonesty behavior, therefore, must be analyzed with insight on high and low risk environment (Leming, 1980), and individual and contextual constructs (McCabe and Travino, 1997).

Age: Typically, studies on college cheating concluded that that the younger the student, the higher the tendency of cheating (Haines, et. al. 1986). A twenty years follow up study was performed in 2007 where age was used as a discriminating variable, confirming that younger students cheat more than older students. This variable seems to be consistent with studies conducted from the late 1980s to more recent studies (Vandehey, Diekhoff, and LaBeff, 2007).

Gender: Unlike age, there are contradictory findings in past studies about gender. Most early researchers concluded that females cheat less than male students (Hetherington and Feldmen, 1964; Roskens and Dizney, 1966). McCabe and Travino reported in their 1997 study that male students cheat more than female students, however, the claim was made that contradicting reports were due to unique circumstances on individual campuses and therefore were driven by other factors (McCabe and Travino, 1997). Sex-Role socialization theory was used to explain the relationship between male and female students' cheating, arguing that female students were more likely than male students to be socialized to obey rules (Ward and Beck, 1990). Other studies explored this traditional gender difference and concluded insignificant differences between male and female student cheating (Baird, 1980; Lipson and McGavern, 1993). Two studies were found which reported a higher level of cheating in female students than male students (Leming, 1980; Antion and Michael, 1983). Lupton, Chapman, and Weiss, (2000) reported that female students will engage in cheating more freely when the risk of detection is reduced and when the threat of sanctions by a faculty member is at a minimum.

Cultural Identity: A major nationwide, multi-campus study was conducted in Taiwan to study the academic dishonesty of college students (Lin and Wen 2007). Lin and Wen found considerable differences between male and female students' practices of academic dishonesty; they found that male students exhibited higher tendency of cheating in exams and paper plagiarism than female students. This study showed that studies conducted in different geographical areas from European and Asian countries revealed the same amount of cheating in college students and was consistent with findings in the United States (Lin and Wen, 2007, p. 87). However, research showed that there are significant international differences in the students' attitude towards academic misconduct. Students' cultural identities may play a part in the tendency toward academic misconduct; therefore, the present study used cultural identity as a moderating variable. Magnus, Polterovich, Danilov, and Savvateev (2002) conducted a multi-nations study to analyze the tolerance of cheating across four countries: Russia, The Netherlands, Israel, and the United States. Their sample contained 885 students; 506 students from Russia, 112 from the United States, 247 from Netherlands, and 20 from Israel. The result showed that Russian students were more tolerant of cheating activities, condemning students who will act as informers and bringing academic dishonesty intensity to a high level. Students in the United States and the Netherlands were shown to be more concerned and willing to report academic dishonesty. "One would, therefore, expect that the higher the level of education, the less tolerant students were of the person who cheated" (p.128).

Socioeconomic Status: Haines, Diekhoff, Labeff, and Clark's (1986) study showed that socioeconomic status will affect the students' commitment to education and advancement. Their analysis of the data demonstrated that students who have financial support from their parents tend to cheat at a higher rate than students who are financially self-supported.

Grade Point Average: Studies have been quite consistent when measuring academic dishonesty using grade point average or academic achievement as the independent variable (Hetherington and Feldmen, 1964; Roskens and Dizney, 1966; Baird, 1980; Lipson and McGavern, 1993; McCabe and Travino, 1997; and Vandehey, Diekhoff, and LaBeff, 2007). Leming presented a theoretical rationale for this phenomenon, claiming that students with a lower grade point average have less to lose and more to gain and therefore they tend to undertake the extra risks (Leming, 1980).

Parents' Level of Education: Parents' education as an indicator of academic dishonesty has been used less commonly than any other indicator in past studies. The children of a higher social class may be better prepared for higher education and have higher commitment to education and advancement (Bowers, 1964). Although Bowers' findings were that children from a higher social class are less likely to cheat, the relationship was very weak. Another study showed the opposite finding from Bowers' study, but also with a weak relationship (Kirkvliet, 1994)

The unethical conduct of some high profile companies attracted the attention of educators on decision-making ethics. The negative results of this behavior led some educators to the conclusion that ethical decision-making training must be emphasized within their curriculum (Northam and Diels, 2007). In the past few years, this conclusion has been echoed by educators in the aviation field and resulted in concern for including ethics training in many areas of aviation instruction (Oderman, 2002). Unethical behavior stories within the aviation industry are normal occurrences in our society. These stories appear regularly in the front page of newspapers and in other forms of media and there is evidence of unethical behavior in the early days of aviation.

Unethical behavior is not limited to the aviation industry. Each instance lessens the confidence of the public exponentially, whether it is in corporate business, medicine, the political arena, or public transport. The *Ethics Officer & Compliance Association* reported in 1977 that nearly half of the workers in the United States had engaged in some unethical or illegal activities in the previous year (Oderman, 2002). Oderman (2002) concluded in his study that ethics is an issue of concern in the aviation education community.

Conceptual Change Theory

Many researchers describe misconception as a belief that is held contrary to known evidence. Misconception is mostly formed as the result of limited personal experiences, observations, or social interactions and inaccurate prior instructions. Many researchers refer to misconception as naïve psychological science to indicate that an individual will acquire these ideas in a primitive way through trial-and-error (Taylor & Kowalski, 2004).

Conceptual change learning refers to the type of learning that occurs when the learner is introduced to new knowledge that is in conflict with earlier knowledge and must reorganize presented schemata and change formerly held ideas (Kowalski & Taylor, 2004). This type of knowledge reorganization often works better with students who are able to engage in effortful processing, evaluating old beliefs and comparing them with new logical and more valuable concepts. Because this type of evaluation involves effort on the part of the learner, it is often more likely that the learner will choose to ignore or reject conflicting beliefs instead of reorganize his or her belief system (Chinn & Brewer, 1993). As a result of this rejection by the learner, changing misconceptions is difficult and the learner will often leave the class with the same misconceptions with which he or she entered. This struggle to change is more evident in below-average learners, who might be less capable of understanding the new information, and in learners with low metacognitive skills, who might be unable to detect inconsistencies between the old and the new information (Dole & Sinatra, 1988).

Researchers suggest that inconsistent prior knowledge makes it difficult for the learner to acquire a new concept. An assessment of the misconceptions the learner brings to class is essential for a teacher if the intent is to build on these misconceptions, building on these misconceptions will help the learner achieve sophisticated understandings and enables him or her to accept the new knowledge (Kowalski & Taylor, 2004). Ninety freshman students volunteered to take part in a study by Taylor and Kowalski (2004), the researchers surveyed the participants at the start and end of an introductory psychology course using conceptual change learning theory as the treatment. The researcher concluded that the treatment was able to reduce the misconceptions of the learners by 30 percent.

Ethics across the Curriculum

All colleges teach ethics across the curricula, yet only few colleges make explicit attempt to coordinate the ethical lessons their students should be learning (Matchett, 2008; Oderman, 2002). Teaching ethics across the curriculum can be used as an alternative to implementing a dedicated ethics course in cases where there is simply no room for adding an additional course in the program of study. Teaching ethics across the curriculum can also be used for supporting and reinforcing material in the dedicated ethics course.

Does the knowledge of ethics and moral constructs affect behavior? This question has long been a topic of debate among educators, psychologists, and philosophers. There is agreement between researchers in various areas of study that there is a weak link between students' knowledge of ethics and moral constructs and ethical behavior. A student can know right from wrong and choose to act against his or her better judgment as a result of rationalization or the influence of his or her environment (Harris, 2008).

Ethics is covered in many disciplines in universities, as a required course or sometimes as an elective for other programs. Student's participation in ethics courses, for the purpose of changing behavior, does not offer the students the opportunity to evolve in their moral developments. Previous research indicated that the inclusion of ethics courses in a formal educational setting has little, if any, ethical behavior benefit. For ethics courses to have any effect on behavior they must be accompanied by role models (Gundersen, Capozzoli, & Rajamma, 2008; Christensen & Kohls, 2003; Goolsby & Hunt, 1992; James, 2000; Kohlberg, 1969). Implementing ethics across the curriculum without having a dedicated ethics course might have an effect on ethical behavior (Ben-Jacob, 2005).

Disagreements between Greek philosophers on some aspects of knowledge of ethics and behavior were indicated by Irwin (1995); however, general agreement that the individual who is more knowledgeable on the subject of ethics tends to demonstrate more virtuous behavior was also noted. Socrates believed that having the right knowledge was all an individual would need to live a virtuous and good life. He supported the idea that one's behavior was an indicator of his or her knowledge about morality. Plato, on the other hand, believed that one's behavior indicated an inherent knowledge of virtue. Different from Socrates, Plato also believed that an individual must be exposed to appropriate behavior to possess knowledge of virtue and for moral education to have any effect on behavior, the behavioral model must come first (Irwin, 1995). Aronfreed (1978), a psychologist who conducted numerous studies about child development, concluded that behavior was partially controlled by conditions separate from rational thought.

To offset the position that knowledge might not be a valid predictor of behavior, Rest (1979) conducted a study demonstrating that the number of years of formal education and the progressive ability to effectively confront moral dilemmas were strongly related. While this study was not able to show that formal education is a direct predictor of behavior, Rest claimed that the exposure to higher levels of education offered the students different models and methods of processing that have an effect on the students' decision-making approach (Rest, 1979).

Jennings (1999) agreed with Aronfreed's (1978) study in his article "What happened to business schools?" stating that Master's in Business Administration (MBA) students are cynically resigned to participate in unethical business practices despite all their business ethics education. This attitude is attributed to the factors controlling the business environment of the 21st century. It is difficult to determine the long-term effects of an ethics course when only measuring the effects before and after the course. When measuring the results at the end of the course, there are mixed interpretations of ethical dilemmas by students. Gundersen, Capozzoli, and Rajamma (2008) conducted a study on the progression of students' ethical beliefs throughout their education. They concluded that circumstantial ethics experience has more of an effect on an individual's behavior than a conventional ethics class; the ethics class was not a direct predictor of students' behavior (Gundersen, Capozzoli, & Rajamma, 2008). Too often, the study of ethics is presented to students in its philosophical context, but are we teaching the right things? In most colleges, the study of ethics is treated as an academic exercise with some professors going a step further by introducing ethical issues in their respective discipline. A better approach on the part of professors might be to take a stand and impart ethics, to teach the right behavior. Presently, the direction we need to go regarding ethics' education is clear; it is also clear that our present ethics' education is not aiming in that direction (Cavaliere, Mulvaney, & Swerdlow, 2010).

Ethical education is not changing unethical behavior; this is evident when we read about all the business scandals in recent times (Cavaliere et al., 2010). While researchers agree that ethics education is not a direct predictor of ethical behavior, there is evidence that individuals who had been exposed to higher levels of ethics education are inclined to make higher-level ethical decisions. This supports the notion that ethical behavior can be influenced by exposing students to different types of ethical dilemmas and case studies (Rest & Narvaez, 1994).

Ethics education and the effect on student behavior have been debated by researchers for four decades. Some researchers support the idea that as individuals progress through different levels of moral development (Kohlberg 1974), their ability to deal with ethical dilemmas will improve, thus changing their ethical behaviors. This process can be achieved through formal education (Christensen & Kohls, 2003; Goolsby & Hunt, 1992; James, 2000; Kohlberg, 1969; Cavaliere et al., 2010). Other researchers disagree, claiming that an academic course will not change the student's ethical behaviors because by the time the student reaches college he or she has already formed ethical standards and beliefs (Gundersen, Capozzoli, & Rajamma, 2008; Cragg, 1997). Churchill (1982) suggested that the distinction between ethics and morals is the key of the trainability of ethics. Ethics can be taught as a rational reflection upon a choice of behaviors. Moral values are developed earlier in the individual's life and the trainability while attending college is questionable at best. Churchill's (1982) suggestion raises questions for those researchers claiming that ethics cannot be taught, because students' ethical behaviors are formed earlier in each individual's life.

METHODOLOGY AND DATA COLLECTION

Participants

The population for this study was limited to second year professional pilot students enrolled in aviation professional pilot four year degree programs at five accredited institutions of higher education within the United States. Two institutions with no formal ethics course in their curriculum and three institutions with a formal ethics course in their curriculum were selected. These five institutions were carefully chosen because of the similarity of courses within their program and the sequence of courses throughout the four years. It is necessary to clarify that an ethics course is not a required course by the Federal Aviation Administration for professional pilot training; therefore, it becomes optional for institutions. The expectation was to survey between 30 and 50 students from each institution totaling 150 to 250 participants. A total of 150 valid surveys were received and used for this study.

Instrument

The instrument used was designed to collect quantitative data. This instrument was developed for the purpose of measuring students' attitudes and behaviors toward academic dishonesty and ethical standards, and students' neutralization and normalization behaviors. Part I of the survey instrument was designed to gather demographic data from the participants: age, gender, grade point average, cultural identity, socioeconomic status, parents' level of education, and type of flight training. Part II of the survey instrument was structured with four subscales: attitude towards academic dishonesty, attitude towards neutralization behavior, attitude towards normalization of deviance, and ethical standards. Part II, section one, of the survey instrument contained 32 items using a six-point Likert scale. This section was designed to collect participants' data regarding neutralization behavior and normalization of deviance. The responses included: strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree. The response of strongly disagree holds a numerical value of one while the response of strongly agree holds a numerical value of six.

Part II, section two, of the survey instrument contained nine items using a five-point Likert scale. This section was designed to collect participants' data on academic dishonesty behavior and perception. The participant was given situations concerning academic conduct and was asked to answer in two subscales: (a) Have you engaged in the behavior since entering the aviation program? The response options included: never, seldom, sometimes, often, and very often. The response of 'never' holds a numerical value of one and the response of 'very often' holds a numerical value of five; (b) How honest do you consider this behavior to be? The response options included: honest, slightly honest, slightly dishonest, very dishonest, and extremely dishonest. The response of 'honest' holds a numerical value of one and 'extremely dishonest' holds a numerical value of five.

Part II, section three, of the survey instrument contained 12 items using a five-point Likert scale. This section was designed to collect participants' data on ethical standards behavior and perception. The participant was given ethical situations and was asked to answer in two subscales: (a) have you engaged in the following behavior since entering the aviation program? The responses options included; never, seldom, sometimes, often, and very often. The response of 'never' holds a numerical value of one while the response of 'very often' holds a numerical value of five: (b) how ethical do you consider this action to be? The responses options included: ethical, slightly ethical, slightly unethical, very unethical, and extremely unethical. The response of 'ethical' holds a numerical value of one while the response of 'extremely unethical' holds a numerical value of five.

Validity of the Original Survey Instrument

Content validity was obtained by using an expert panel composed of three full-time student pilots, one member of the full-time aviation faculty, and one professional with ethics expertise. The panel was given definitions of academic honesty, ethical behavior, neutralization behavior, and normalization of deviance. The survey instrument contained 53 total items for panel review. Seventeen items pertain to neutralization behavior, 15 items pertain to normalization of deviance, nine pertain to academic honesty, and 12 items pertain to ethical standards. The expert panel was asked to carefully read all items and categorize each of them in accordance with the definitions given; in addition, the panel was asked to comment on the clarity of the questions and statements. In order for an item to be included in the revised survey instrument, three out of the five panel members were required to accept it. The responses were reviewed and all questions in the revised survey were deemed clear and valid. The raw score of each subscale is presented in Table 1.

Table 1. *Survey Instrument Raw Scale*

Subscale	Item number	Total Items	Raw Score Range
Ethical Standards	42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53	12	24-120
Academic Honesty	33, 34, 35, 36, 37, 38, 39, 40, 41	9	18–90
Neutralization Behavior	2, 3, 5, 7, 8, 10, 13, 15, 17, 20, 21, 24, 26, 27, 28, 29, 31	17	17-153
Normalization of Deviance	1, 4, 6, 9, 11, 12, 14, 16, 18, 19, 22, 23, 25, 30, 32	15	15-90

Factor Analysis

Fifty-three items on the survey instrument were subjected to factor analysis utilizing 150 usable responses to obtain discrete subscales. To determine the number of factors to retain, the Kaizer-Guttman rule was first applied, followed by the Cattell's scree test. The Kaizer-Guttman rule was applied to define all factors with eigenvalues greater than one. It was followed by the Cattell's scree test to examine the magnitude of changes in eigenvalues from one factor to another. The dimensionality of the 150 usable responses was analyzed using principle component factor analysis. The result of the Kaizer-Guttman revealed 15 components with an eigenvalue greater than one. Analysis of the Cattell's scree clearly showed six factors with significant changes between eigenvalues, which was confirmed by the scree plot from the extraction process where a clear break showed after the sixth subscale. The six discrete subscales accounted for 61.91 percent of the variance. Based on these analyses, six factors were rotated using a Varimax rotation procedure. The rotation solution yielded six interpretable factors: Ethical Conduct (EC), Ethical Beliefs (EB), Academic Conduct (AC), Academic Honesty Belief (AHB), Neutralization Behavior (NB), and Normalizations of Deviance (ND).

Thirteen items loaded in more than one dimension. Item 25 loaded for both, Neutralization Behavior (NB) and Normalization of Deviance (ND). Item 51a loaded for both Neutralization Behavior (NB) and Ethical Conduct (EC). Items 34a, 47a, 48a, 36a, 35a, and 40a loaded for both Ethical Conduct (EC) and Academic Honesty Beliefs (AHB). Items 33b, 34b, 35b, 36b, 37b, 40b, and 41b loaded for both, Ethical Beliefs (EB) and Academic Honesty Beliefs (AHB). An attempt was made to use Varimax as a rotation method to investigate whether these items would be associated with an additional dimension. The attempt showed no other dimension for these items. After a reliability test was performed on individual variables, the items were retained based on factor analysis loading showing significant differences between factor loading and the reliability test showing no significant difference in the Cronbach's Alpha by keeping the items as part of the variable. Items 28, 41a, and 53a did not load in any factors and were consequently deleted from the analysis.

Table 2 indicates the distribution of the 71 items that were retained for this study as a result of the factor analysis, alpha coefficient, and raw score range of each of the six variables.

Table 2. *Scale Reliability Resulting from Factor Analysis*

Subscale	Items Number	Total Items	Range of Scores	α
Ethical Conduct (EC)	42a, 43a, 44a, 45a, 46a, 47a, 48a, 49a, 50a, 51a, 52a	11	11-55	.893
Ethical Beliefs (EB)	42b, 43b, 44b, 45b, 46b, 47b, 48b, 49b, 50b, 51b, 52b, 53b	12	12-60	.955
Academic Conduct (AC)	33a, 34a, 35a, 36a, 37a, 38a, 39a, 40a	8	8-40	.849
Academic Honesty Beliefs (AHB)	33b, 34b, 35b, 36b, 37b, 38b, 39b, 40b, 41b	9	9-45	.958
Neutralization Behavior(NB)	2, 3, 5, 7, 8, 10, 13, 15, 17, 20, 21, 24, 26, 27, 29, 31	16	16-96	.924
Normalization of Deviance (ND)	1, 4, 6, 9, 11, 12, 14, 16, 18, 19, 22, 23, 25, 30, 32	15	15-90	.896

After factor analysis, the research question was revised to reflect all six factors names.

Revised Research Question

How do student pilots in higher education institutions, with and without formal ethics courses, describe their Ethical Conduct (EC), Ethical Beliefs (EB), Academic Conduct (AC), Academic Honesty Beliefs (AHB), Neutralization Behavior (NB), and Normalization of Deviance (ND)?

The research question was answered using *t*-test and descriptive statistics, means, SD, and frequencies to analyze results.

DATA ANALYSIS

Preliminary information about the respondents is presented here. Sixty nine and one half percent of the respondents were Caucasian/white, 13.6% identify themselves as Hispanic/Latino, 5.2% Asian, and 9.1% African-American/Black. Table 3 shows student participants GPA. The majority of the students reported their score to be between 3.0 and 3.5 (51.5%), followed by 32.1% of students reporting GPA scores between 3.6 and 4.0.

Table 4 shows the type of flight training of the students participating in the survey. Student flight training is regulated by the Federal Aviation Administration. Students take their training under one of the two types of course structure designated by the FAA; 14§CFR61 Subpart E through F or 14§CFR141

Appendices B through D. Curriculums under 14§CFR141 Appendices B through D are overseen by the FAA and are more rigorous then curriculums under 14§CFR61 Subpart E through F.

Table 3. *Students' Grade Point Average*

GPA	Frequency	Percent	Valid Percent	Cumulative Percent
2.0 to 2.5	5	3.2	3.7	3.7
2.6 to 2.9	17	11.0	12.7	16.4
3.0 to 3.5	69	44.5	51.5	77.9
3.6 to 4.0	43	27.7	32.1	100.0
Total	134	86.5	100.0	
Missing	21	13.5		
Valid N	Valid N	155	100.0	

Table 4. *Students' Type of Flight Training*

	Frequency	Percent	Valid Percent	Cumulative
14§CFR61	24	15.5	19.5	19.5
14§CFR141	99	63.9	80.5	100.0
Total	123	79.4	100.0	
Missing	32	20.6		
Valid N	Valid N	155	100.0	

Table 5 shows students' cultural identity. Most students indicated their cultural identity to be American (77.4%) with 22.6% reporting other cultural identities.

Table 5. *Students' Cultural Identity*

	Frequency	Percent	Valid Percent	Cumulative Percent
U.S.A.	120	77.4	77.4	77.4
Latin American	9	5.8	5.8	83.2
Caribbean	4	2.6	2.6	95.8
Western European	12	7.7	7.7	93.5
African	3	1.9	1.9	95.5
Asian	4	2.6	2.6	98.1
Eastern European	3	1.9	1.9	100.0
Total	155	100.0	100.0	

RESEARCH QUESTION

How do student pilots in higher education institutions, with and without formal ethics courses, describe their Ethical Conduct (EC), Ethical Beliefs (EB), Academic Conduct (AC), Academic Honesty Beliefs (AHB), Neutralization Behavior (NB), and Normalization of Deviance (ND)?

The research question investigated the students' self-reported ethical conduct and beliefs, their academic conduct and academic dishonesty beliefs, their attitude towards neutralization behavior, and their attitude toward normalization of deviance. For this analysis, *t*-test and descriptive statistics were used in order to generate the frequency of student engagement in these behaviors and to represent the differences, if any, between the two groups.

Eleven questions were selected to measure the participant's ethical conduct. Descriptive statistics were used to generate the frequency of student engagement in unethical behaviors. Survey responses were scored using 1=Very Often, 2=Often, 3=Sometimes, 4=Seldom, and 5=Never. The mean score for frequency of student engagement in unethical behavior, with a range of 11 to 55, was 54.06 for students enrolled in institutions with mandatory ethics course in their curriculum. The mean score for frequency of student engagement in unethical behavior, with a range of 11 to 55, was 53.60 for students enrolled in institutions without mandatory ethics course. The data indicate that as a group, students enrolled in institutions with mandatory ethics course tend to engage less frequently in unethical behaviors.

Table 6 reports the number of responses, the mean, standard deviation, and number of items for both, students enrolled in institutions with mandatory ethics course and students enrolled in institutions without mandatory ethics course. Table 7 reports the result of the *t*-test.

Table 6. *Mean and Standard Deviation for Ethical Conduct*

School with Ethics Course	N	M	SD	Number of Items
Ethical Conduct	81	54.06	2.71	11
Valid N (listwise)	81			
School without Ethics s Course	N	M	SD	Number of Items
Ethical Conduct	68	53.60	2.84	11
Valid N (listwise)	68			

Table 7. *t*-test Ethical Conduct (EC)

	School Code	N	M	SD	SDE	t	df	ρ	Mean
	Ethics Course	81	54.06	2.71	0.20	1.00	147	0.31	0.46
	No Ethics Course	68	53.60	2.84	0.36				

Descriptive statistics were performed to analyze the frequency of students' engagement in each of the eleven behaviors. Table 8 reports the frequency of student engagement in specific unethical behavior. Twelve questions were selected to measure the participants' ethical beliefs. Descriptive statistics were used to generate the frequency of student unethical beliefs. Survey responses were scored using 1=Ethical, 2=Slightly ethical, 3=Slightly unethical 4=Very unethical, and 5=Extremely unethical.

The mean score for frequency of student ethical beliefs, with a range of 36 to 60, was 51.20 for students enrolled in institutions with mandatory ethics course in their curriculum. The mean score for frequency of student ethical beliefs, with a range of 31 to 60, was 52.37 for students enrolled in institutions without mandatory ethics course in their curriculum. The data indicate that as a group, students enrolled in an institution without a mandatory ethics course perceive these behaviors to be very unethical while students enrolled in institutions with an ethics course perceive this action to be slightly more acceptable than that of the first group.

Table 8. *Frequency of student engagement in specific unethical behaviors*

	School With Ethics Course			School Without Ethics Course		
	N	S+ST	O+VO	N	S+ST	O+VO
Coming to the airport and providing services to passengers, on the ground or in the air, under the influence of drugs, including alcohol.	97.6%	2.4%	0.0%	94.4%	4.2%	1.4%
Not reporting an incident that involves passengers.	98.8%	0.0%	1.2%	98.6%	0.0%	1.4%
Recording flight time that was not flown.	95.2%	3.6%	1.2%	95.7%	2.8%	1.5%
Reporting and/or recording flight procedures when it was not performed.	95.2%	3.6%	1.2%	95.7%	2.8%	1.5%
Inaccurate recording or reporting aircraft discrepancies.	92.8%	7.2%	0.0%	95.7%	4.3%	0.0%
Reporting weather phenomenon that was not observed or recalled accurately.	94.0%	6.0%	0.0%	91.3%	8.7%	0.0%
Attempting to perform a procedure in which you are not competent or current without the assistance of a Certified Flight Instructor.	88.1%	10.7%	1.2%	85.7%	14.3%	0.0%
Contaminating the environment, intentionally or by accident and not reporting it to the proper authority.	91.7%	8.3%	0.0%	85.9%	11.3%	2.8%
Losing, breaking, or damaging passengers' belongings and not reporting it.	96.4%	3.6%	0.0%	94.3%	5.7%	0.0%
Reporting inaccurately to a passenger the cause of a delay in a flight.	88.0%	12.0%	0.0%	85.5%	14.5%	0.0%
Reporting operational problems with an aircraft inaccurately.	96.4%	3.6%	0.0%	91.4%	5.7%	2.9%

N=Never, S=Seldom, ST=Sometimes, O=Often, VO=Very Often

Table 9 reports the number of responses, the mean, standard deviation, and number of items for both students enrolled in institutions with mandatory ethics course and students enrolled in institutions without mandatory ethics course and Table 10 represents the result of the *t*-test. Table 11 reports the frequency of student answers on ethical beliefs.

Table 9. *Mean and Standard Deviation for Ethical Beliefs*

School with Ethics Course	N	M	SD	Number of Items
Ethical Beliefs	77	51.20	8.34	12
Valid N (listwise)	77			
School without Ethics Course	N	M	SD	Number of Items
Ethical Beliefs	69	52.37	7.02	12
Valid N (listwise)	69			

Table 10. *t-test Ethical Beliefs (EB)*

School Code	N	M	SD	SDE	t	df	ρ	Mean Difference
Ethics Course	77	51.19	8.34	0.96	-0.92	144	0.36	-1.18
No Ethics Course	69	52.38	7.02	0.86				

Table 11: *Frequency of students' Ethical Beliefs*

	School With Ethics Course			School Without Ethics Course		
	E+SE	SU	VU+EU	E+SE	SU	VU+EU
Coming to the airport and providing services to passengers, on the ground or in the air, under the influence of drugs, including alcohol.	1.2%	15.9%	82.9%	2.8%	1.4%	95.8%
Not reporting an incident that involves passengers.	0.0%	19.4%	80.6%	1.4%	5.6%	93.0%
Recording flight time that was not flown.	1.2%	19.5%	79.3%	0.0%	11.3%	88.7%
Reporting and/or recording flight procedures when it was not performed.	0.0%	22.2%	77.8%	1.4%	16.9%	81.7%
Inaccurate recording or reporting aircraft discrepancies.	0.0%	23.2%	76.8%	1.4%	15.5%	83.1%
Reporting weather phenomenon that was not observe or recalled accurately.	2.4%	29.3%	68.3%	7.1%	19.7%	73.2%
Attempting to perform a procedure in which you are not competent or current without the assistance of a Certified Flight Instructor.	3.7%	30.9%	65.4%	2.8%	26.8%	70.4%
Contaminating the environment, intentionally or by accident and not reporting it to the proper authority.	0.0%	22.0%	78.0%	2.8%	15.5%	81.7%
Losing, breaking, or damaging passengers' belongings and not reporting it.	0.0%	17.1%	82.9%	2.8%	12.7%	84.5%
Reporting inaccurately to a passenger the cause of a delay in a flight.	4.9%	30.9%	64.2%	10.2%	21.7%	68.1%
Reporting operational problems with an aircraft inaccurately.	0.0%	17.3%	82.7%	4.1%	9.9%	86.0%
Not reporting any physical or health related change that may delimit my flying capacity.	2.4%	18.3%	79.3%	11.3%	11.3%	77.5%

E=Ethical, SE=Slightly Ethical, SU=Slightly Unethical, VU=Very Unethical, EU=Extremely Unethical

Eight questions were selected to measure the participants' academic conduct, survey responses were scored using a five point liker scale ranging from 1) = Very often, 2) = Often, 3) = Sometimes, 4) =

Seldom, and 5)= Never. A score of five represents excellent academic conduct while a score of one represents extremely weak academic conduct.

The mean score for frequency of student academic conduct, with a range of 31 to 40, was 38.10 for students enrolled in institutions with mandatory ethics course in their curriculum. The mean score for frequency of student academic conduct, with a range of 30 to 40, was 37.60 for students enrolled in institutions without mandatory ethics course in their curriculum. The data shows that the academic conduct of these two groups of students is very similar. As a group, they reported never or seldom engaging in academic dishonesty activities.

Table 12 reports the number of responses, the mean frequency of student academic conduct, the standard deviation, and the number of items. Table 13 represents the results of the *t*-test. Table 14 reports the frequency of student specific behavior of academic conduct.

Table 12. *Mean and Standard Deviation for Academic Conduct*

School with Ethics Course	N	M	SD	Number of Items
Academic Conduct	79	38.10	2.48	8
Valid N	79			
School without Ethics Course	N	M	SD	Number of Items
Academic Conduct	68	37.60	2.86	8
Valid N	68			

Table 13: *Academic Conduct (AC)*

School Code	N	M	SD	SDE	t	df	ρ	Mean Difference
Ethic Course	79	38.10	2.48	0.27	1.13	145	0.26	0.50
No Ethic	68	37.60	2.86	0.34				

Nine questions were selected to measure the participants' academic dishonesty beliefs, survey responses were scored using a five point liker scale ranging from 1) = Honest, 2) = Slightly honest, 3) = Slightly dishonest, 4) Very dishonest, and 5) Extremely dishonest. A score of five represents a good understanding of academic dishonesty while a score of one represents a misunderstanding of academic dishonesty.

The mean score for frequency of students' academic dishonesty beliefs, with a range of 23 to 45, was 37.41 for students enrolled in institutions with mandatory ethics course in their curriculum. The mean score for frequency of students' academic dishonesty beliefs, with a range of 25 to 45, was 37.00 for students enrolled in institutions without a mandatory ethics course in their curriculum. The data shows that as a group, they reported having a good understanding about academic dishonesty.

Table 14. *Frequency of student engagement on specific behaviors of Academic Conduct*

	School With Ethics Course			School Without Ethics Course		
	N	S+ST	O+VO	N	S+ST	O+VO
Getting test questions from another pilot student who has taken the exam or quiz at an earlier time.	69.1%	29.7%	1.2%	74.6%	23.9%	1.5%
Copying from another pilot student's test without their knowledge.	91.6%	8.4%	0.0%	91.4%	8.6%	0.0%
Copying from another pilot student's test with their knowledge.	86.9%	13.1%	0.0%	88.7%	11.3%	0.0%
Receiving answers from another pilot student during a test.	88.0%	12.0%	0.0%	85.9%	14.1%	0.0%
Allowing a pilot student to copy answers from you during a test.	81.0%	19.0%	0.0%	79.7%	20.3%	0.0%
Using notes, books, cell phones etc. during a closed book test to gain answers.	88.0%	12.0%	0.0%	80.0%	20.0%	0.0%
Paraphrasing or copying material from another source without referencing the source.	66.3%	33.7%	0.0%	60.9%	37.7%	1.4%
Working with another student on an out of class assignment when not allowed by the instructor.	65.4%	32.1%	2.5%	68.6%	27.1%	4.3%

N=Never, S=Seldom, ST=Sometimes, O=Often, VO=Very Often

Table 15 reports the number of responses, the mean frequency of students' academic dishonesty beliefs, the standard deviation, and the number of items. Table 16 reports the result of the *t*-test. Table 17 reports the frequency of students' specific behaviors representing academic dishonesty beliefs.

Table 15. *Means and Standard Deviation for Academic Dishonesty Beliefs*

School with Ethics Course	N	M	SD	Number of Items
Academic Dishonesty Beliefs	81	37.41	6.77	9
Valid N	81			
School without Ethics Course	N	M	SD	Number of Items
Academic Dishonesty Beliefs	63	37.00	6.15	9
Valid N	63			

Table 16. *t-test Academic Dishonesty Beliefs (ADB)*

School Code	N	M	SD	SDE	t	df	ρ	Mean Difference
Ethic Course	81	37.41	6.77	0.76	0.37	142	0.71	0.41
No Ethic Course	63	37.00	6.15	0.80				

Table 17. *Frequency of students' academic dishonesty beliefs*

	School With Ethics Course			School Without Ethics Course		
	H+SH	SD	VD+ED	H+SH	SD	VD+ED
Getting test questions from another pilot student who has taken the exam or quiz at an earlier time.	8.3%	32.1%	59.6%	4.3%	34.3%	61.4%
Copying from another pilot students' test without their knowledge.	0.0%	13.1%	86.9%	1.4%	8.5%	90.1%
Copying from another pilot students' test with their knowledge.	1.2%	25.0%	73.8%	2.9%	14.3%	82.8%
Receiving answers from another pilot student during a test.	3.6%	25.0%	71.4%	0.0%	15.9%	84.1%
Allowing a pilot student to copy answers from you during a test.	1.2%	26.2%	72.6%	5.6%	16.9%	77.5%
Using notes, books, cell phones etc. during a closed book test to gain answers.	0.0%	20.5%	79.5%	0.0%	20.0%	80.0%
Paraphrasing or copying material from another source without referencing the source.	1.2%	36.1%	62.7%	2.8%	28.2%	69.0%
Working with another student on an out of class assignment when not allowed by the instructor.	2.5%	39.5%	58.0%	12.9%	34.3%	52.8%
Developing a personal relationship with the aviation professor to gain information about the test.	13.2%	26.5%	60.3%	10.5%	26.9%	62.6%

H= Honest, SH= Slightly honest, SD= Slightly dishonest, VD= Very dishonest, ED= Extremely dishonest

Sixteen questions were selected to measure the participant's neutralization behavior, survey responses were scored using a six point Likert scale ranging from 1) Strongly disagree, 2) Disagree, 3) Slightly disagree, 4) Slightly agree, 5) Agree, to 6) Strongly agree. A score of one defined a strong resistance to neutralize their actions, while a score of 6 defined a strong attitude to neutralize their action.

The mean score for frequency of students' neutralization behavior, with a range of 15 to 90, was 81.06 for students enrolled in institutions with mandatory ethics course in their curriculum and 75.85 for students enrolled in institutions without mandatory ethics courses in their curriculum. The data indicated that as a group, students enrolled in institutions with mandatory ethics course demonstrate a tendency to resist neutralization behavior while students enrolled in institutions without mandatory ethics course demonstrated only a slight tendency to resist neutralization behavior.

Table 18 reports the number of responses, the mean frequency of students' attitude toward neutralization behavior, the standard deviation, and the number of items. Table 19 represents the results of the *t*-test. Table 20 reports the frequency of students' specific behavior of neutralization.

Table 18. *Means and Standard Deviation for Neutralization Behavior*

School with Ethics Course	N	M	SD	Number of Items
Normalization Behavior	84	81.06	9.71	16
Valid N	84			
School without Ethics Course	N	M	SD	Number of Items
Normalization Behavior	71	75.85	13.29	16
Valid N	71			

Table 19. *t-test Neutralization*

School Code	N	M	SD	SDE	T	df	ρ	Mean Difference
Ethic Course	84	81.06	9.71	1.02	2.82	153	0.04	5.21
No Ethic Course	71	75.85	13.29	1.63				

Fourteen questions were selected to measure the participants' normalization of deviance behavior, survey responses were scored using a six point Likert scale ranging from 1) Strongly disagree, 2) Disagree, 3) Slightly disagree, 4) Slightly agree, 5) Agree, to 6) Strongly agree. A score of one defined a strong inclination to normalization of deviance while a score of 6 defined a resistance to normalization of deviance.

The mean score for frequency of students' attitude toward normalization of deviance, with a range of 63 to 90 was 79.05 for students enrolled in institutions with a mandatory ethics course in their curriculum. The mean score for frequency of students' normalization of deviance, with a range of 63 to 90 was 76.50 for students enrolled in institutions without a mandatory ethics course in their curriculum. The data indicated that as a group, students enrolled in institutions with a mandatory ethics course tend to follow the norms and repel normalization of deviance. Students enrolled in institutions without a mandatory ethics course also tends to follow the norms with a slight tendency towards the direction of normalization of deviance.

Table 20. *Frequency students' specific behavior of neutralization*

	School with Ethics Course				School without Ethics Course			
	STD	D+SLD	A+SLA	STA	STD	D+SLD	A+SLA	STA
Cheating on a test is better than failing the course	45.2%	47.6%	7.2%	0.0%	35.2%	39.5%	23.9%	1.4%
Cheating is okay if the instructor gives unreasonably difficult assignments or tests	45.2%	48.8%	6.0%	0.0%	32.4%	57.8%	9.8%	0.0%
Cheating on a test is okay if the course material is too difficult to understand	48.8%	48.8%	2.4%	0.0%	33.8%	62.0%	4.2%	0.0%
It is okay if you can't study or prepare for a simulation session assignment because you have other commitments.	15.5%	55.9%	28.6%	0.0%	9.9%	54.9%	33.8%	1.4%
Lying to passengers is okay if it does not cause them harm.	31.0%	39.3%	28.5%	1.2%	23.9%	49.3%	24.0%	2.8%
Cheating on a test is okay if everyone else in the class seems to be doing it.	40.5%	58.3%	1.2%	0.0%	33.8%	53.5%	9.8%	2.9%
Cheating on a test is okay if the people sitting around me make no attempt to cover their answers.	58.3%	39.3%	2.4%	0.0%	43.7%	47.9%	5.6%	2.8%
Cheating is okay if a good friend, at risk of failing the course, asks for my help.	38.1%	47.6%	14.3%	0.0%	31.0%	46.5%	19.7%	2.8%
Cheating on a test is okay because students should stick together and help one another.	42.9%	52.4%	2.4%	2.3%	38.0%	49.3%	11.3%	1.4%
Copying a paper from another source is okay if too much coursework is assigned.	52.3%	46.5%	1.2%	0.0%	38.0%	52.1%	8.4%	1.5%
Cheating on a test is okay because it does not hurt anyone.	58.4%	39.2%	1.2%	1.2%	40.8%	53.5%	5.7%	0.0%
It is okay to make up an excuse to not take a test if you have not had time to study for the test.	45.2%	50.0%	3.6%	1.2%	32.4%	52.1%	12.7%	2.8%
Cheating on a test is okay to pass the course.	47.6%	48.8%	3.6%	0.0%	36.6%	49.3%	12.7%	1.4%
Student pilots would not cheat on a test if there was not so much pressured to succeed in the program.	11.9%	47.7%	33.3%	7.1%	16.9%	42.2%	33.8%	7.1%
It is not terrible if you cheat on a test if you have studied hard for the test.	38.1%	52.4%	8.3%	1.2%	29.6%	57.7%	11.2%	1.5%
Cheating or plagiarizing a paper is okay if it is important for me to succeed in the aviation program and be considered successful.	54.8%	45.2%	0.0%	0.0%	42.3%	49.3%	7.0%	1.4%

STD= Strongly Disagree, D= Disagree, SLD= Slightly Disagree SLA= Slightly agree, A= Agree, STA= Strongly agree.

Table 21 reports the number of responses, the mean frequency of students' attitude toward normalization of deviance, the standard deviation, and the number of items. Table 22 reports the result of the *t*-test. Table 23 reports the frequency of students' specific behavior of normalization of deviance.

Table 21. *Mean and Standard Deviation for Normalization of Deviance*

School with Ethics Course	N	M	SD
Normalization of Deviance	78	79.05	7.50
Valid N	78		
School without Ethics Course	N	M	SD
Normalization of Deviance	65	76.50	8.18
Valid N	65		

Table 22: *t-test Normalization of Deviance*

School Code	N	M	SD	SDE	t	df	ρ	Mean Difference
Ethic Course	78	79.05	7.50	0.84	1.86	141	0.03	2.54
No Ethic	65	76.51	8.82	1.13				

Table 23: *Frequency of students' specific behavior on* Normalization of Deviance

	School with Ethics Course				School without Ethics Course			
	STD	D+SLD	A+SLA	STA	STD	D+SLD	A+SLA	STA
Student pilots are responsible for Aeronautical Decision Making and the successful and safe competition of the flight	1.1%	8.4%	54.8%	35.7%	2.9%	5.6%	50.7%	40.8%
It is essential for student pilots to be familiar with the Student Academic Code of Conduct.	0.0%	4.7%	52.4%	42.9%	0.0%	5.7%	62.9%	31.4%
Student pilots must always do what is right	0.0%	11.9%	42.9%	45.2%	0.0%	11.2%	40.9%	47.9%
Adherence to the pilots' Code of Ethics is important to the aviation profession.	0.0%	1.2%	50.6%	48.2%	2.9%	7.0%	38.0%	52.1%
It is essential for student pilots to be familiar with the Pilot Code of Ethics.	1.2%	6.0%	49.4%	43.4%	1.4%	4.2%	52.1%	42.3%
Adherence to the pilots' Code of Ethics is important to me personally.	0.0%	4.8%	55.4%	39.8%	1.4%	5.8%	59.4%	33.4%
Adherence to the pilot's Code of Ethics is important to me professionally.	0.0%	3.6%	47.6%	48.8%	1.5%	10.1%	52.2%	36.2%
Professional pilots are accountable for their own professional practice.	0.0%	3.6%	47.6%	48.8%	1.4%	7.0%	47.9%	43.7%
Professional pilots must continue to grow professionally and technically after completion of the Pilots' Program and their initial training.	2.4%	0.0%	36.1%	61.5%	0.0%	5.7%	38.0%	56.3%
Professional pilots must maintain their competency in the aviation industry.	0.0%	2.4%	34.9%	62.7%	0.0%	5.8%	37.1%	57.1%
Professional pilots must always embrace the values of the pilots' profession.	0.0%	1.1%	59.1%	39.8%	0.0%	10.0%	50.0%	40.0%
Professional pilots have to integrate professional values with their own personal values.	0.0%	3.6%	64.3%	32.1%	0.0%	17.0%	59.1%	23.9%
Professional pilots must always be honest with passengers, crew members, and fellow pilots.	0.0%	9.5%	52.4%	38.1%	1.4%	8.4%	42.3%	47.9%
Professional pilots are responsible for good and sound aeronautical decision making and judgment.	0.0%	2.4%	34.5%	63.1%	1.4%	4.3%	30.0%	64.3%

STD= Strongly Disagree ,D= Disagree, SLD= Slightly Disagree SLA= Slightly agree, A= Agree, STA= Strongly agree

DISCUSSION

Ethics, academic conduct and professional conduct are not new subjects, and they have long been recognized as necessary inclusions in professional pilot curriculum across the United States. In recent times, however, increased emphasis has been placed on these issues due partly to fatal airline accidents. On February 12, 2009 a DHC-8-400 aircraft operating as Continental Connection Flight 3407 crashed short of the runway in Buffalo, N.Y. killing all 50 people on board. As a result of the investigation, the U.S. Congress recommended a formal code of ethics for professional pilots, among other recommendations. The National Transportation Safety Board indicated the probable cause of the accident as,

> "The National Transportation Safety Board determines that the probable cause of this accident was the captain's inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover. Contributing to the accident were (1) the flight crew's failure to monitor airspeed in relation to the rising position of the low speed cue, (2) the flight crew's failure to adhere to sterile cockpit procedures, (3) the captain's failure to effectively manage the flight, and (4) Colgan Air's inadequate procedures for airspeed selection and management during approaches in icing conditions.
>
> The safety issues discussed in this report focus on strategies to prevent flight crew monitoring failures, pilot professionalism, fatigue, remedial training, pilot training records, airspeed selection procedures, stall training, Federal Aviation Administration (FAA) oversight, flight operational quality assurance programs, use of personal portable electronic devices on the flight deck, the FAA's use of safety alerts for operators to transmit safety-critical information, and weather information provided to pilots. Safety recommendations concerning these issues are addressed to the FAA." (National Transportation Safety Board, 2010, p. 155)

This study indicates that a simple ethics courses will not alter student behavior toward academic or ethical conduct. No significant difference was found between these two groups of students in academic conduct, academic dishonesty beliefs, ethical conduct, and ethical beliefs. However, there was a significant difference in neutralization behavior. Students enrolled in ethics course accepted the responsibility for their actions and classified such actions as improper.

Students in curriculums without ethics course tend to shift the blame elsewhere, justifying their actions in their quest of acceptance from society. One of the basic characteristics of students' sub-culture, or the sub-culture of individuals exhibiting deviant behavior, is the possession of a set of values contradicting the set of values held by law-abiding students (Sutherland, 1955). Ethics courses structured to change the students' conception and presenting the students with cases studies of ethical decision making have been proven to be effective in many business schools. Conceptual Change Theory applied in ethics courses presents the students with alternatives to their old beliefs or naïve psychology, challenging the students to re-evaluate their decision-making process.

A significant difference was also found in normalization of deviance. Students enrolled in a course of study without an ethics course tended to deviate from the norms ruling the general student body, and repeated deviations caused them to justify such behavior. This behavior is a byproduct of the neutralization behavior. Therefore, if students' neutralization behavior can be controlled the normalization of deviance should be proportionally reduced.

RECOMMENDATIONS

The need for ethics course in the professional pilot curriculum has been debated for over a decade, yet only few universities has implemented an aviation ethics course as part of the curriculum. This study clearly demonstrated that students who participated in ethics courses were less likely to neutralize their misbehavior and were also less likely to deviate from the norms. Therefore, a recommendation can be made to implement an aviation ethics course as part of the professional pilot curriculum for the benefit of safety.

The literature showed that Ethics Across the Curriculum (EAC) can be used for supporting the stand-alone ethics courses and also for program of study where the addition of a course it is impractical for various reason. EAC was reported to work very well in institutions with faculty support for ethics courses. It is recommended that institutions that have the ability to implement stand-alone ethics course in their curriculum gain support of the faculty and considered implementation of EAC as a support for the course and as a reinforcement for the students.

As this study shows, students in institutions with mandatory ethics course score higher on *neutralization behavior* and *Normalization of Deviance*. However, their conduct and beliefs were similar to those of the students without mandatory ethics course. *Conceptual Change Theory* is used to work with students' misconceptions, the belief that is held contrary to known evidence. These misconceptions are mostly formed as the result of limited personal experiences, observations, or social interactions and inaccurate prior instructions. Many researchers refer to misconception as naïve psychological science to indicate that an individual will acquire these ideas in a primitive way through trial-and-error. Conceptual change learning refers to the type of learning that occurs when the learner is introduced to new knowledge that is in conflict with earlier knowledge and must reorganize presented schemata and change formerly held ideas. This study has uncovered the need for Conceptual Change Theory structure in ethics courses. It is therefore recommended that Conceptual Change Theory be used in already implemented aviation ethics courses and to considered this theory for future ethics courses development.

RECOMMENDATIONS FOR FUTURE STUDIES

A study in which the researcher will randomly select two similar groups of students and administer a pre-test at the start of the semester. The researcher will then administer one group with a treatment, (an ethics course) while the second group will have no treatment. A post-test at the end of the semester will be administered to compare learned behavior and differences between the two groups. This study will give the researcher a clear indication of the effect of ethics course using conceptual change theory.

The ideal study to measure the effect of ethics course in a professional pilot's curriculum will be one where the researcher will randomly survey airline pilots. The survey will include pilots who studied in universities with mandatory ethics course and without ethics course. The survey will then measure the pilots' ethical conduct and beliefs. This will allow the researcher to predict the effect of ethics course with a higher degree of certainty.

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The Utilization of Social Media by Collegiate Aviation Faculty

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ABSTRACT

Social media has taken the world by storm, and there seems to be no slowing down. Young or old, social media has infiltrated our lives in a way never before imagined. Although there are pros and cons to the many social media platforms currently available, it is beneficial for collegiate aviation faculty to learn more about these various tools to determine how, if at all, they can benefit our students. As such, this paper conducted a study of collegiate aviation faculty nationwide and determined that collegiate aviation faculty are very aware of the five most popular social media sites (Skype, YouTube, Facebook, Wikipedia, and Twitter), regularly use YouTube and Wikipedia as part of academic courses, and feel that social photo and video sharing sites provide the most benefit to students. The paper also presents ideas in how to adopt three lesser used social media sites (Twitter, LinkedIn, and Ning) for the benefit of students.

INTRODUCTION

> Millennials thrive in an always 'on' world filled with digital music devices, cell phones, the Internet, instant messenger and social networks. They are in constant touch, updating their friends with texts (80 per day on average according to Nielsen), tweets and messages on the 'walls' of their Facebook profiles. This world of interactivity and hyper-communication has fundamentally changed how teenagers and young adults receive, process and act on information (Barnes & Mattson, 2010).

Social media was relied upon by 774 million people worldwide in 2010 – including children, teens, and adults. Having grown from 373 million users in 2007, it is expected to grow to over 1 billion users by 2012, which equates to 21% of the worldwide population. With so many users, social media is changing the way we interact and "socialize" with the world around us. Aspiring brides- and grooms-to-be are finding their love, marrying, and beginning a family. Long-lost family members are being reunited. Law enforcement personnel are capturing criminals. At the same time, however, students are being bullied. Spouses are having affairs. Employee productivity is being lost. While there is nothing new about these events, they have been aided, whether positively or negatively, by the use of social media (Olausson, 2007).

With both pros and cons to social media, one wonders about the impacts of such media on higher education. Clearly, the use of social media within higher education is changing the landscape of how students interact, how students learn, and how faculty interact with students. Consider a walk through the hallway prior to class. Many of the students standing in the hallway are interacting with each other, but not in person; rather, they are using social media to communicate, possibly even with the peer standing next to them. It seems many of them are plugged in, but out of touch at the same time. Possibly the same could be said of faculty. Indeed, it has been said that undivided attention may be the most valued commodity of the 21st century.

With today's traditional college student having been born between 1989 and 1993, we as faculty are educating a generation of students that grew up with computers and the ability to communicate electronically. As educators, we should be aware of the abilities of such technology and decide for ourselves how to best utilize this technology. Specifically regarding social media, faculty currently use this type of technology personally, as well as professionally. This article examines the use of social media by faculty within collegiate aviation.

REVIEW OF LITERATURE

Social media, by its very nature, is difficult to define. For the first time, we as humans are face-to-face with a digital medium that is "user-created, user-controlled, flexible, democratic, and both very transparent and very not so" (Moran, Seaman, & Tinti-Kane, 2011, p. 4). Perhaps the most unique aspect of social media is that once content is shared, it invites conversation. As a result, social media is dynamic, interactive, and inviting. Suffice to say, social media comprises "activities that involve socializing and networking online through words, pictures, and videos" (Ruben, 2008, p. 1).

Although Facebook is the most popular social network with more than 500 million active users, it belongs to only one of ten categories of social media ("Facebook Statistics," 2011; Reuben, 2008). According to Cavazza (2008), there are ten categories of the social media landscape (graphically shown in Figure 1):

1. Publication tools
    a. Blogs
    b. Wikis
    c. Citizen journalism portals
2. Sharing tools
    a. Videos
    b. Pictures
    c. Links
    d. Music
    e. Slideshows
    f. Product reviews
    g. Product feedback
3. Discussion tools
    a. Forums
    b. Video forums
    c. Instant messaging
    d. VoIP
4. Social networks
    a. General social networks
    b. Niche social networks
    c. Tools for creating social networks
5. Micropublication tools
6. Social aggregation tools
7. Livecast hosting platforms
8. Virtual worlds
9. Social gaming platforms
10. Massively multiplayer online games (MMO) or massively multiplayer online role playing games (MMORPG)

Figure 1. Social Media Landscape
Source: Cavazza, 2008.

Although this landscape can be quite intimidating, especially for faculty that may not even use social media in their personal lives, five of these ten categories contain the social media sites most commonly used by faculty both personally and professionally, according to a 2011 study conducted by Pearson (Moran, et. al, 2011). These categories, with the most popular sites among faculty in parenthesis, are as follows:

1. Publication tools (Wikipedia)
2. Sharing tools (YouTube, Flickr)
3. Discussion tools (Skype)
4. Social networks (Facebook)
5. Micropublication tools (Twitter)

Even among similar categories, the characteristics of these sites vary. The characteristics of the most popular social media sites, as well as their use by faculty nationwide, are presented below.

Wikipedia

A wiki is a website that allows the creation and editing of interlinked web pages without knowledge of HTML. Wikipedia is a wiki that is a web-based, collaborative, multilingual encyclopedia. It boasts 18 million articles (with over 3.6 million in English) that have been written collaboratively by volunteers from around the world ("Wikipedia," 2011). Characteristic of Wikis, Wikipedia entries can generally be edited by anyone with access to the site. This is, of course, the main reason why faculty are hesitant to use Wikipedia or allow students to use it as a reference for research projects. Even so, according to Moran et. al. (2011), 5% of surveyed faculty post on Wikis (of a personal nature) while 14% visit (of a personal nature) in a given month. Of these faculty, 28% use Wikis for professional (nonclass) purposes. Although the study only examined Wikis, and not Wikipedia specifically, it discovered that 9% of faculty use Wikis in class and 6% use Wikis to post content for class. At the same time, 11% of faculty assign students to read/view Wiki posts, while 7% assign students to post on a Wiki.

YouTube

YouTube is considered the world leader in online video, and has become the number one source to watch and share original videos. The interface allows users the opportunity to easily upload and share video clips, which can be accessed through websites, mobile devices, blogs, and email (Reuben, 2008). YouTube boasts that more than 13 million hours of video were uploaded during 2010 and 35 hours of video are uploaded every minute. In fact, more video is uploaded to YouTube in 60 days than the 3 major U.S. networks created in 60 years ("Youtube statistics," 2011). According to Moran et. al. (2011), only 8% of surveyed faculty post on YouTube (of a personal nature) while 49% visit (of a personal nature) in a given month. Of these faculty, 57% use this site for professional (nonclass) purposes. Although the study did not specify YouTube, 61% of surveyed faculty access online video in class and 21% post online video for class. Likewise, 32% of faculty assign students to view online video, while 10% assign students to post online video.

Flickr

Flickr is an online photo sharing site that allows users to upload photos that can be organized in sets and collections. Photos can then be viewed and commented on by others (Reuben, 2008). Flickr is currently home to over five billion digital images ("Flickr explore," 2011). According to Moran et. al. (2011), only 2% of surveyed faculty post on Flickr (of a personal nature) and 6% visit (of a personal nature) in a given month. Of these faculty, 11% use this site for professional (nonclass) purposes. The Pearson study did not investigate the use of Flickr or similar photo sharing sites with regards to class use, yet it is clear that Flick is not that popular among faculty.

Skype

Skype allows users to communicate with each other via text, voice, and video on a telephone, computer, or TV with Skype software. It also allows group video and conference calling. Skype has an average of 145 million connected users monthly. Skype users made 207 billion minutes of voice and video calls in 2010, approximately 42% of which was video ("About skype," 2011). Unfortunately, the Pearson study did not analyze the use of discussion tools, such as Skype.

Facebook

Facebook, with more than 500 million active users and over 900 million objects to interact with, is the most popular social network and likely the most popular social media ("Facebook Statistics," 2011). This social utility connects people by allowing the sharing of photos, links, videos, content, and more.

Although it was originally launched for Harvard University students in 2004, the site now welcomes anyone over the age of 13. Facebook is made up of six components: personal profiles, status updates, networks, groups, applications, and fan pages (Reuben, 2008). According to Moran et. al. (2011), 43% of surveyed faculty post on Facebook (of a personal nature) and 57% visit (of a personal nature) in a given month. Of these faculty, 45% use this network for professional (nonclass) purposes. However, only 4% use Facebook in class, only 3% use it to post content for class, and only 3% and 2%, respectively, assign students to read/view or post.

Twitter

Twitter is categorized as a micropublication tool because users are limited to 140-character updates. The site is considered a cross between instant messaging and blogging. Users can also follow the updates ("tweets") posted by people they follow, send them direct messages, reply publicly to friends, or post questions or comments as their status update (Reuben, 2008). The top users of this site have almost 11 million followers ("Twitter users you should follow," 2011). According to Moran et. al. (2011), only 6% of surveyed faculty post on Twitter (of a personal nature) and 11% visit (of a personal nature) in a given month. Of these faculty, 13% use this network for professional (nonclass) purposes. Only 2% use Twitter in class, to post content for class, or assign students to read/view posts. Clearly, Twitter is not widely used among faculty.

RESEARCH METHOD

To gather faculty perceptions regarding social media and determine the manner in which social media is being utilized by collegiate aviation faculty, the researcher identified the nationwide population of collegiate aviation faculty for this study. The most complete contact information for this population is maintained by the University Aviation Association (UAA). As a result, the researcher utilized the entire professional membership listing for the UAA, which included 199 members at the time of the study.

To gather data from collegiate aviation faculty, a brief, online questionnaire was developed. The unique researcher-designed questionnaire for this project contained 11 items, and focused on the personal and professional use of social media by collegiate aviation faculty, the perceived use of social media among collegiate aviation students, and the specific integration of social media within academic courses by collegiate aviation faculty. During late Spring 2011, IRB approval for this project was granted. During early summer 2011, the survey of collegiate aviation faculty was conducted. After an initial contact and one follow-up, the study yielded 80 responses, equating to a 40.2% response rate.

Responses represent a wide range of collegiate aviation programs. For instance, 94.7% of participants represent four-year institutions, while 5.3% represent two-year institutions. Programs of all sizes, based on the number of students, were also represented. The most common size programs are: 90-119 students (13% of participants), 190-229 students (11.7%), and 600 or more students (22.1%). Lastly, programs with less than 3 faculty to 19 or more were represented. The three most common size programs, based on the number of collegiate aviation faculty, are: 3-6 faculty (26% of participants), 7-10 faculty (18.2%), and 19 or more faculty (28.6%).

The following questions guided this research effort:

1. What social media platforms are most popular and how do they work?
2. In what way do collegiate aviation faculty currently utilize social media in the classroom?
3. How can collegiate aviation faculty use social media to reach and interact with students?

It should be noted that this study only examined faculty perceptions and did not gather data from students or the general population. As such, these results only reflect perceptions of collegiate aviation faculty in the U.S.

RESULTS

To gain insight into the popularity of social media by collegiate aviation students, faculty participating in this study were asked to define the percentage of their students utilizing social media on a regular basis (defined as five or more days per week). Although students were not surveyed, and this finding only indicates faculty perception, no less than 72% of participants indicate that over 80% of their students interact with social media regularly.

Collegiate aviation faculty were also asked about their use of social media. A large majority, 80%, utilize some form of social media in their personal life. However, professionally, only 49% use social media.

Participants were also queried about their degree of awareness of the various social media tools. As seen in Figure 2, participants were most aware of the six most popular social media sites discussed previously. Specifically, Skype, YouTube, Facebook, Wikipedia, and Twitter were all very familiar to the participants. These findings among collegiate aviation faculty were similar to findings among faculty nationwide (as presented in the Pearson study), with the exception of Flickr. Among faculty nationwide, 84% were aware of Flickr, whereas 59.8% of collegiate aviation faculty are (Moran, et. al., 2011).

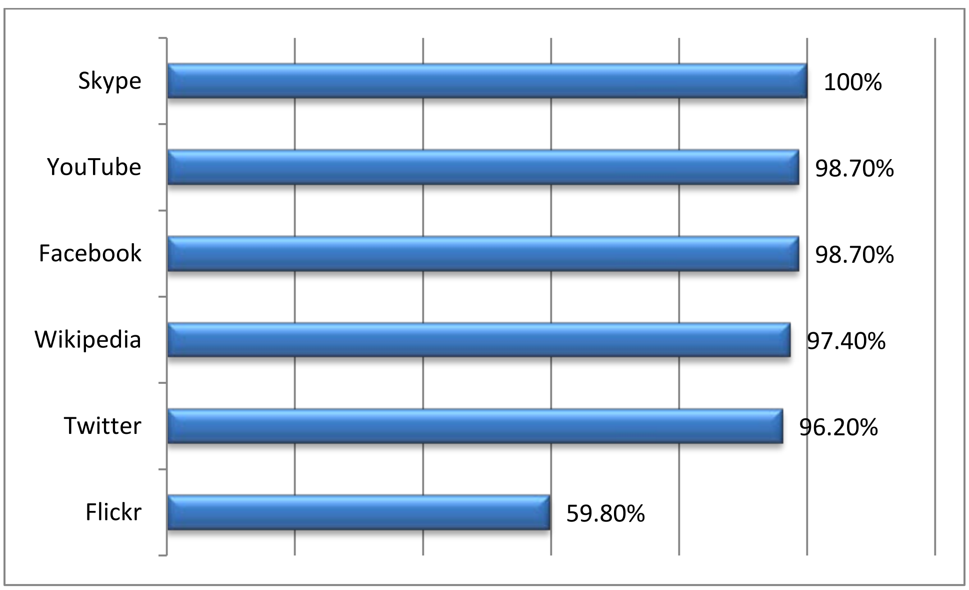

Figure 2. Degree of Awareness
(Note: Percentages represent total responses in the categories of “very aware” and “somewhat aware.”)

When presented with the various social media tools and asked to designate how frequently these tools are used as part of academic courses, collegiate aviation faculty once again chose the six most popular sites previously discussed (Figure 3). It appears that YouTube is used most frequently on a daily or monthly basis, while Wikipedia is used second most frequently. The popularity of YouTube among collegiate aviation faculty is comparable to faculty nationwide (according to Moran, et. al., 2011).

However, it appears that collegiate aviation faculty utilize Wikipedia as part of an academic course more so than do faculty nationwide (50% compared to only 6-11%, respectively).

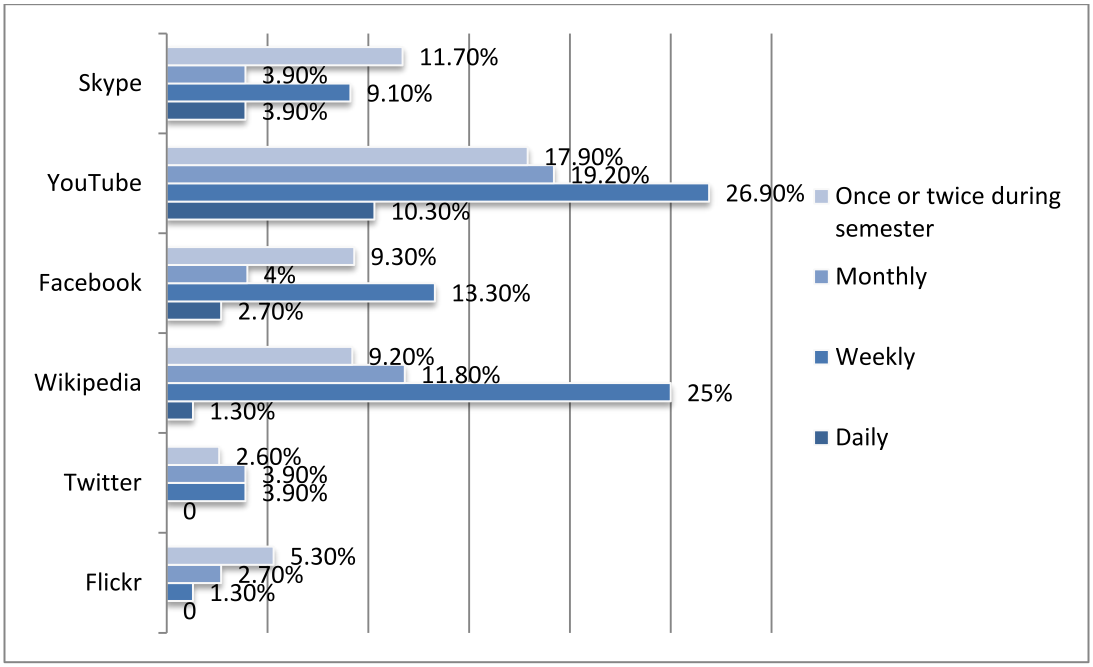

Figure 3. Frequency of use of social media in academic courses

When asked how beneficial the various categories of social media tools can be to collegiate aviation students if properly utilized by faculty, the findings were similar to findings of faculty nationwide, although collegiate aviation faculty are slightly less enthusiastic about the benefits. It is clear, however, that collegiate aviation faculty do perceive some benefits of these various tools.

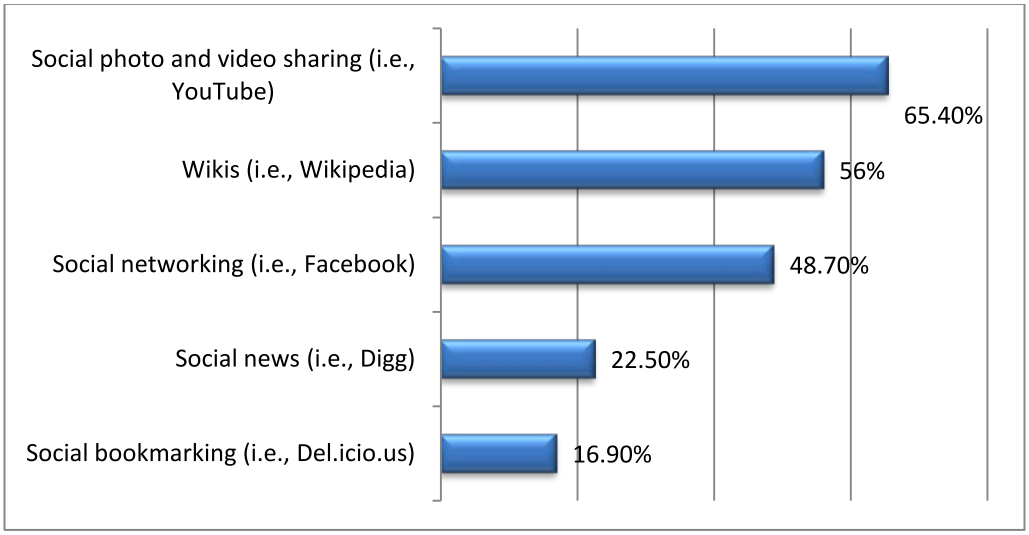

Figure 4. Degree of social media benefits
(Note: Percentages represent total responses in the categories of "Very beneficial" and "beneficial.")

To determine in what way these social media tools are currently being utilized as part of academic courses, collegiate aviation faculty were asked to share in that regard. Although the responses to this open-ended item varied, some common themes emerged.

First, it is quite clear from the responses that YouTube is most heavily utilized in the classroom. The reasons for this include: videos of aircraft accidents, accident investigations, and human factor issues; stimulating humor; integrating a visual component to the class; explaining a concept better; stimulating discussions; and gaining student attention.

It appears from the responses that Wikipedia is the second most popular social platform in the classroom. It is used for initial fact finding, general information, presenting concepts in layman's terms, beginning research, quickly looking up a term or concept, exploring links in the reference section, and finding various graphs for use in PowerPoint slides. However, faculty should be cautioned that as a Wiki, Wikipedia suffers from a lack of verified accuracy, resulting in questionable credibility.

Skype appears to be the third-most used social media tool as part of academic courses. It is used for guest speakers, one-on-one conferencing, communication with students at satellite campuses, communication between students and faculty while the faculty is away from campus, and interaction between students in a lab.

It appears that Facebook and Twitter are also used as part of academic courses, but to a much lesser degree than YouTube, Wikipedia, and Skype. Generally Facebook is used to stay connected to and interact with students. Twitter is used by at least one faculty member to post class and location status updates for his/her class.

DISCUSSION

According to Blankenship (2011), social media is becoming "so dominant in the classroom that it's hard to imagine any professor or student making it through a week without them (p. 39)." However, as the Pearson study showed, social media tools can be used by faculty in class, for postings outside of class, and/or as part of student assignments. Likewise, faculty can use social media personally and for professional nonclass use. According to the results of this study, it appears that collegiate aviation faculty use YouTube regularly to show videos in class, but don't necessarily post videos on this site. Facebook is used quite heavily by faculty, but likely to keep in touch with old college friends, rather than in the classroom. Skype is used occasionally in the classroom, while Wikis and Flickr are not used very often.

It is clear, however, that social media is being utilized by a large percentage of collegiate aviation faculty, as well as faculty nationwide. As Rheingold (as cited in Blankenship, 2011) states, the benefits of social media to students are plenty, including "greater engagement, greater interest, [and] students taking more control and responsibility for their education" (p. 40). Although some may question these benefits, clearly, "It's a lot more work for a professor to use social media properly, to comment on a blog, or edit a wiki" (p. 41). And, as Rheingold asks, "Are the professors getting paid more for that? Probably not" (p. 41).

Even so, there are effective ways to utilize social media in class, outside of class, and as part of student assignments. To provide ideas for and stimulate discussion on the use of social media, as well as introduce three social media platforms that are not as popular among collegiate aviation faculty, three unique examples are presented below.

Twitter

Even though Twitter only allows concise 140-character "tweets," students can benefit from this site in several ways. In the classroom, faculty can use Twitter to follow various members, such as Ray LaHood, the U.S. Secretary of Transportation (@RayLaHood) or the International Civil Aviation Organization (@ICAOHQ). Their "tweets" will likely stimulate discussion and allow faculty to bring current events into the classroom. Outside of class, faculty can use Twitter to immediately "tweet" news, course information, class cancellations, and more to students. Regarding student assignments, students can be assigned members to follow on Twitter or even learn to leverage Twitter in developing a personal brand. Although LinkedIn is probably the best place to begin building a personal brand, Twitter allows a student to leverage the growth of that brand by producing a particular "voice" and engaging in micropublication. Students will also benefit from the 140-character limit of Twitter. Presenting their ideas in a concise fashion takes work, but leads to more in-depth thought as students try to avoid going over the Twitter-imposed character limit ("About Twitter," 2011).

LinkedIn

Although LinkedIn is considered a professional social network, faculty can effectively leverage this site to benefit students. In the classroom, faculty can post questions to industry experts and obtain quick answers. Faculty can also search through position announcements to benefit students. Outside of class, faculty can post various updates to their profile and respond to student questions. As an assignment, students (particularly senior-level students) could be required to develop a professional profile on this site. By encouraging students to begin thinking in "real-world" terms and requiring them to build an online, Linked-in style resume, students will understand the importance of developing a professional image. As an added bonus, there have been many instances of employers scanning profiles on LinkedIn and finding potential employees ("About us," 2011).

Ning

Social networks are amazingly popular today. Even so, some faculty feel they have limited use in the classroom, or even outside for that matter. Outside the classroom, faculty should be cautious of becoming friends with students in a social network. This is especially true because the faculty member has no control over that social network (other than the content they post). However, students love social networks and faculty can benefit from the ability to stay connected to, and communicate with, students outside of class.

Although almost 95% of survey respondents are unaware of Ning, it is one solution to this social network dilemma. Ning is a social media platform that almost 95% of collegiate aviation faculty are unaware of, according to the results of this study. As a social network, it does not necessarily compete with Facebook and MySpace. Rather, Ning allows for a unique social network to be built by the Administrator, allowing only invited members to participate. The Administrator maintains complete control over users, content, etc. Once up and running, students are invited to join, and can build their profile. They can post photos, share videos, make friends, post messages on a wall, send private messages, and develop blog posts and forums. The Administrator has complete control over the entire social network, including the degree of control given to users (students). The one drawback is the cost. However, it is quite reasonable. Depending on the pricing plan selected, the annual cost varies from $19.95 to $239.90 to $599.90 ("About ning," 2011).

In the classroom, faculty can bring up the Ning network and showcase photos, videos, and blogs posted by students. Outside of class, students can communicate with each other in groups, and learn about job opportunities and other newsworthy events posted by faculty or other members. Students can be assigned to various groups and be required to communicate outside of class using this platform. They can also be assigned a blog and be required to regularly update it.

As a faculty member at Middle Tennessee State University, I have developed a very effective social network for students in the Aerospace Administration (Aviation Management) concentration. This network allows me to post job announcements, internship opportunities, departmental news and events, photos, video, blog posts, and much more. Students are very appreciative and thoroughly enjoy the site. If this is being considered, however, it is imperative to develop User Guidelines, as below:

> This site has been created by Dr. Prather to allow MTSU Aerospace Administration students to stay connected. Here, you can share all of your wonderful aviation adventures, network with classmates, and keep up on the latest events and opportunities in Aviation. Since aviation is an extremely professional industry, we ask that any posted pictures, blogs, comments, etc. be directly related to aviation. Although this is a social network, it is not Facebook, and is considered an extension of the classroom. Therefore, if you wouldn't do it in class, please don't do it on here. We reserve the right to promptly remove any members violating this policy. Thanks and enjoy!

With these guidelines in place, I have only had to ask two members to remove a photograph, and if desired, the Administrator can approve all photos before they are even posted. In that way, a social network can be developed whereby a faculty member is in complete control.

CONCLUSION

"I do not think we understand . . . how the web is going to reshape what we do. (Bollinger, as cited in Miller, 2011, para. 7). The web is definitely changing how we gather information and interact with the world around us. Based on their rapid growth and rise in popularity (among all demographics), it would seem that social media tools are here to stay. According to Moran et. al. (2011), "Higher education's ability to take advantage of social media for promoting professional development, broadening institutional research, and increasing student success is nothing short of revolutionary" (p. 4). Regardless of whether collegiate aviation faculty agree with this statement, research suggests that we "start empowering ourselves to use social media well" (Blankenship, 2011, p. 42). For some of us, that might mean not using social media at all, or at least not in the classroom. For others, it might mean integrating social media into every class session. Wherever each of us find ourselves along that continuum, our choices should be well-informed, which was a goal of this study.

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The Impact of Specialized Accreditation on Program Quality:
Aviation Students' Perspectives

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ABSTRACT

Quality assurance of academic programs has traditionally been through accreditation. Specialized accreditation is a means for specific academic fields to ensure quality. In the field of aviation, the Aviation Accreditation Board International (AABI) is the sole accrediting agency for collegiate aviation programs. Currently 25 percent of the institutions that offer four year non-engineering aviation degrees have one or more of their programs accredited by AABI. The purpose of this study was to examine if students' perceptions of quality differ between accredited and non-accredited programs using the quality dimensions of curriculum, faculty, environment, facilities and equipment, student outcomes and overall satisfaction.

Students currently enrolled in four year aviation degree programs from 22 institutions participated in the study. The findings indicated that significant differences in students' perceptions of quality exist in favor of accredited programs for curriculum, and facilities and equipment, as well as for several measures of faculty quality. Additionally, students in accredited programs perceived that their degree was preparing them well for their intended career to a significantly greater extent than students in non-accredited programs. Results of this study have implications for administrators and faculty seeking to improve the quality of their programs.

INTRODUCTION

Today the aviation industry faces unprecedented challenges. Airways are overcrowded and are being managed by antiquated systems, airports are faced with increasing delays, security threats pose real risks to the travelling public and the global economy, and training standards for our nation's pilots are under scrutiny. The industry is dependent upon having highly qualified, properly trained individuals admitted into the various sectors of this industry.

Collegiate aviation programs are a vital resource for providing the industry with competent personnel. Collegiate programs, however, can vary considerably on the level of standards they adhere to and on how they are administered. Quality of programs can vary considerably from institution to institution, even when required to meet minimum FAA standards as is the case for programs involving flight training or the licensing of aircraft mechanics. The Council on Aviation Accreditation (CAA), an offshoot of the University Aviation Association, was established in 1988 to assure program quality to various stakeholders, namely the educational community and the public they serve. Does specialized accreditation impact the quality of programs? Do levels of student satisfaction in accredited and non-accredited programs differ? All institutions, regardless of their accreditation status or accreditation intentions, can benefit from having a better understanding of student perceptions of quality. Maintaining a satisfied student body is a key element in the viability of any academic program.

RELATED LITERATURE

Defining Quality in Higher Education

Defining quality in higher education is an evolving task and is largely dependent upon whose perspective is being discussed (Alstete, 2004; Harvey & Green, 1993; Nordvall & Braxton, 1996; Van Kemenade, Pupius, & Hardjono, 2008). Quality can be viewed as an absolute, similar in nature to beauty and truth (Sallis & Hingley, 1991) or in terms of thresholds that must be attained to be labeled quality. Another view of quality relates the processes to the outcomes, rather than to an absolute threshold (Harvey & Green, 1993).

In 1993, Harvey and Green grouped the widely varying conceptualizations of quality into five distinct, yet interrelated categories as follows: (1) exception, which relied on the traditional view of exclusiveness even though it offered no benchmarks in defining quality. It relied more on the notion that quality was instinctively known when it was encountered; (2) perfection, which related quality to consistency of performance. This moved away from the exclusiveness theory of quality and made it obtainable to those able to conform to, and maintain specific standards; (3) fitness for purpose, more of a functional definition of quality, which measured how well the end product or service, met the intended purpose of the users; (4) value for money; and (5) transformative or "value added" concept. Much attention has been given to this last conceptualization category which argues that both input and output data must be analyzed over time to gain a sense of what was gained by completing a particular program of study. For example, if only the best and brightest students are recruited into a program, one would expect high levels of achievement and outcomes at the program's completion. Caution must be exercised in assuming excellence merely for having recruited bright students (Astin, 1995). This transformative concept of quality has been widely accepted as a true indicator of quality in higher education (Astin, 1985, 1993, 1995; Nightengale & O'Neill, 1994) and has led to an emphasis on outcomes by accrediting bodies in recent years.

Although "quality" of a program can mean many different things to different people, the elements of curriculum, faculty, facilities, finances and students are common elements given in defining program quality (Alstete, 2004; Harvey & Green, 1993; Van Kemenade, et. al, 2008). These factors alone however, do not assure high quality. Outcome variables and the environment of the program need to be considered when analyzing quality. The impact of a program's environment on learning has been recognized by many (Astin, 1985, 1993; Nightingale & O'Neill, 1994; Sergiovanni, 1994) yet is often neglected due to the difficulty in assessing it (Astin, 1993). The importance of the learning environment and student outcomes in determining quality is evidenced by the shift of accrediting agencies from input criteria to process (environment) and outcomes assessments (Prather, 2007).

Defining Quality in Collegiate Aviation Programs

The University of Illinois Institute of Aviation surveyed graduates of their program for the period 1950 – 1978. Results of this study shed some light on what the quality indices of aviation programs were from an alumni perspective and included curriculum, facilities and equipment, and industry placement services (Johnson & Sredl, 1979). Fifteen years later, Kuhns (1994) set out to establish a quality norm for collegiate aviation programs by surveying program chairs on their perceptions of what constituted key quality factors for aviation programs. In this study, faculty, facilities and equipment, curriculum, internships and financial resources were all identified as important determinants of program quality.

Lindseth (1996) recognized the need to identify quality indicators for collegiate aviation programs, particularly those programs that had flight training as a component. He developed a model of quality for collegiate aviation programs by surveying "experts" in the field, which consisted of baccalaureate aviation program administrators and directors of flight training from U.S. based airlines. The model that was developed based on this research included ten quality indices: curriculum, students, faculty, program activities, equipment, facilities, leadership, resources, reputation and value. Using regression analysis, curriculum and faculty were both found to be predictors of program quality. These ten quality indices were further validated by Hankins (2007) who surveyed aviation educators and industry representatives.

Accreditation

As the system of institutions of higher education was developing in the United States, it became apparent that some form of standardization among institutions was necessary. Variations in standards and degree requirements were making credit transfers and admittance into graduate programs a difficult task. This resulted in a movement to establish minimum standards in the year 1890 (Alstete, 2004).

Today accreditation remains the primary means of assuring program quality to students and the public (Alstete, 2004; Eaton, 2009). In the United States, institutions of higher education operate with considerable autonomy and independence unlike some other countries that exist under a centralized authority such as a Federal Ministry of Education. Both the federal and state governments in this country consider accreditation to be a reliable indicator of quality and although voluntary, limit government sponsored financial aid to institutions that are accredited (Eaton, 2009).

Specialized Accreditation

Specialized accreditation is a means of assuring quality for specific academic programs. Programs seeking specialized accreditation are typically required to be part of a regionally or nationally accredited program and thus lend additional prestige to the program (Prather, 2007). However, specialized accreditation can be viewed as redundant. Costs associated with the specialized accreditation process can be excessive and the time and energy commitment required of the faculty and staff is often overwhelming (Litwack, 1986). Many programs considering specialized accreditation claim that they are not able to meet the accreditation criteria, particularly curricula standards. Many programs stated they were under no pressure from stakeholders to seek specialized accreditation and that their alumni have proven to be successful without it (Prather, 2007).

Aviation Accreditation Board International

The Aviation Accreditation Board International (AABI) is the sole specialized accrediting body for collegiate aviation programs and is a nonprofit, nongovernmental agency whose members include educators, industry representatives and regulators. AABI is an offshoot of the University Aviation Association (UAA), a non-profit organization that was founded in 1947 to serve the needs of the aviation educational community. A survey conducted by the UAA revealed a general consensus for the need of a specialized accrediting agency for aviation degree programs. In October, 1988, the UAA established the Council on Aviation Accreditation (CAA) as an autonomous, legally charted entity (UAA, n.d.). By 1992, the CAA had accredited eight programs at four schools (Lindseth, 1996). Today the scope has expanded to include international programs. In 2006, the CAA officially adopted the name Aviation Accreditation Board International to better reflect this aim and to avoid possible confusion with the Civil Aeronautics Authority abroad.

There are 103 institutions offering four year non-engineering aviation degrees in this country. Approximately one fourth of these institutions have a program that is accredited by AABI (AOPA, 2009). A 2007 study set out to determine why such a small percentage of the institutions were accredited. Program administrators, aviation students and industry employers were surveyed to measure their perception of the value of AABI accreditation (Prather, 2007).

Administrators of accredited programs cited prestige, standardization and ability to attract quality faculty as the benefits of accreditation. The reasons for not seeking accreditation given by non-accredited program administrators were most often centered on a cost/benefit analysis. The costs in terms of the financial resources and faculty man-hours needed to complete the required self study were perceived to be greater that the returned benefits. Many institutions viewed the specialized accreditation process as redundant with their institutions regional accreditation. Students were found to have little awareness of the existence of AABI and reported that AABI accreditation did not influence their decision to enroll in a particular program. Industry employers were also found to lack AABI awareness, contradicting previous assumptions held by AABI and academics that graduates of accredited programs were preferred by industry (Prather, 2007).

PURPOSE OF THE STUDY

The purpose of this study was to determine if students' perceptions of collegiate aviation program quality differed between AABI accredited and non-accredited four year degree programs. Quality was defined by the dimensions of curriculum, faculty, environment, facilities and equipment, student outcomes and overall satisfaction.

METHODOLOGY

Subjects

Students currently enrolled in four year, non-engineering aviation degree programs across the United States were invited to participate in this study. Students between the ages of 18 and 64 years were approved by the Internal Review Board process to participate in this study.

Survey Instrument

A survey was developed to measure student perceptions of quality based on a thorough review of past research efforts involved in defining quality of collegiate programs. Due to the limited publications specific to the field of aviation, the literature review included past research efforts across several disciplines. Part one consisted of ten demographic questions for analysis purposes and part two measured the quality dimensions of curriculum, faculty, environment, facilities and equipment, student outcomes, and student level of satisfaction with their degree program. Students were asked to report their level of agreement on 50 items using a five point Likert scale (see Appendix A). To ensure content validity, the survey was juried by a five member committee consisting of three faculty members from AABI accredited programs and two from non-accredited programs. To determine the reliability of the instrument, Cronbach's alpha coefficients of internal consistency were calculated for each variable and ranged from .66 - .88. According to George and Mallory (2003) acceptable Chronbach alpha coefficients for social science research studies can be defined as follows: greater than .9 - excellent; greater than .8 – good; greater than .7 – acceptable; greater than .6 – questionable; greater than .5 – poor; less than .5 – unacceptable. The scale reliability for each variable is given below in Table 1.

Table 1. *Scale Reliabilities*

Variables	Items	Range of Scores	Alpha Coefficient
Curriculum	2, 11, 14, 25, 32, 38, 45r	7 - 35	0.66
Faculty	6, 13, 15, 19, 22, 26, 34r, 40r, 42, 44	10 - 50	0.86
Environment	1, 3, 7, 21r, 27, 35, 37r, 39, 43, 46	10 - 45	0.77
Facilities and Equipment	5, 10, 12, 18, 31, 49,50	7 - 35	0.76
Student Outcomes	4, 9,17, 23r, 28, 30, 36, 41, 47	9 - 45	0.83
Level of Satisfaction	8, 16, 24, 29, 33, 48	6 - 30	0.88

An 'r' denotes item reversal for statistical purposes

Data collection

An electronic version of the survey was developed and distributed to aviation faculty members soliciting their help in making the survey available to students. Faculty members attending the AABI annual conference in July, 2010 and faculty members listed on the UAA's website were targeted for assistance. Additionally, faculty members attending the UAA's annual conference in October, 2010 were asked if they would be willing to distribute the survey either electronically or in hard copy to their students. Copies of the survey, along with self-addressed stamped envelopes were provided to faculty agreeing to assist in this way. The electronic link was active mid-September through November 1, 2010, resulting in 267 electronic submissions. An additional 282 paper surveys were returned in the mail.

DATA ANALYSIS AND FINDINGS

Demographics

A total of 549 surveys were returned from 22 institutions representing the five geographic regions of the United States, yielding 510 survey submissions valid for analysis. Table 2 illustrates the demographics of the participants in regards to geographic location of the institution.

Table 2. *Demographics of the Participants (geographic location of institution) (N = 510)*

	Respondents	Percent	Valid Percent	Cumulative Percent
Location				
Northeast	32	6.27	6.30	6.30
Southeast	138	27.06	27.17	33.46
Midwest	245	48.04	48.23	81.69
Southeast	73	14.31	14.37	96.06
West	20	3.92	3.94	100.00
Total	508	99.61	100.00	
Missing	2	.39		
Total	510	100.00		

The geographic regions were adopted from the online resource "Thinkquest Library for this study and are defined as follows (United States Regions, 1998):

- Northeast: Connecticut, Delaware, Maine Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and Washington D.C.
- Southeast: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia.
- Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin.
- Southwest: Arizona, New Mexico, Oklahoma and Texas
- West: Alaska, California, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming.

Table 3 illustrates the demographics of the participants regarding the accreditation status of their program and their major course of study.

Table 3. *Demographics of the Participants (accreditation status and major course of study)(N = 510)*

	Respondents	Percent	Valid Percent	Cumulative Percent
Accredited Status				
Accredited	344	67.45	68.66	68.66
non-accred	157	30.78	31.34	100.00
Total	501	98.24	100.00	
Missing	9	1.76		
Total	510	100.00		
Major				
prof. pilot/flight edu	277	54.31	55.62	55.62
aviation adm/mgmt	132	25.88	26.51	82.13
aviation studies	46	9.02	9.24	91.37
Air Traffic Control	38	7.45	7.63	99.00
aviation maintenance	5	.98	1.00	100.00
Total	498	97.65	100.00	
Missing	12	2.35		
Total	510	100.00		

As depicted in Table 3, approximately two thirds of the respondents were enrolled in an AABI accredited program and over one half of the respondents were enrolled in programs focused on pilot training. Further analysis of the respondents' demographics by class level, GPA and gender is given in Table 4.

Table 4. *Demographics of the Respondents (class level, GPA and gender) (N = 510)*

	Respondents	Percent	Valid Percent	Cumulative Percent
Class Level				
Freshman	91	17.84	17.98	17.98
Sophomore	94	18.43	18.58	36.56
Junior	162	31.76	32.02	68.58
Senior	159	31.18	31.42	100.00
Total	506	99.22	100.00	
Missing	4	.78		
Total	510	100.00		
GPA				
under 2.0	0	.00	.00	.00
2.0 - 2.49	25	4.90	5.07	5.07
2.5 - 2.99	112	21.96	22.72	27.79
3.0 - 3.49	197	38.63	39.96	67.75
over 3.5	159	31.18	32.25	100.00
Total	493	96.67	100.00	
Missing	17	3.33		
Total	510	100.00		
Gender				
Male	444	87.06	87.06	87.06
Female	66	12.94	12.94	100.00
Total	510	100.00	100.00	

Thirteen percent of the surveys were submitted by females representing a higher percentage than is found in industry. Females account for approximately six percent of the 600,000 active pilots in the United States and approximately four percent of the non-pilot aviation jobs (*About WAI*, 1996 - 2010).

Quality Perception Analysis

A series of independent-samples *t* tests was conducted to analyze the means of accredited and non-accredited institutional responses for the quality dimensions of curriculum, faculty, environment, facilities and equipment, student outcomes, and overall satisfaction. Table 5 illustrates the results of the *t* tests for each of the variables. Results of the *t* tests indicated that student perceptions of quality were higher in accredited programs. Students in accredited programs on average perceived the quality of their curriculum, $t(251.01) = 3.68$, $p \leq .00$ and of their facilities and equipment, $t(497) = 2.61$, $p = .01$, significantly higher than students in non-accredited programs. It is interesting to note that aviation educators and industry representatives have ranked the top three quality characteristics of collegiate aviation as: 1. curriculum; 2. faculty; and 3. equipment (Hankins, 2007).

Table 5. *Independent Samples t test Comparing How Students' Perceptions of Quality Differ Based on Accreditation Status of Their Program (N_a=344, N_n=157)*

	accreditation status	N	M	SD	*t*	df	*p*
Curriculum	accredited	326	28.30	3.32	3.68	251.01	.00
	non-accred	151	26.93	3.97			
Faculty	accredited	328	41.25	5.45	1.59	473	.11
	non-accred	147	40.35	6.23			
Environment	accredited	323	36.80	5.95	-.15	471	.88
	non-accred	150	36.89	5.72			
Facilities & Equipment	accredited	342	28.59	4.21	2.61	497	.01
	non-accred	157	27.51	4.56			
Student Outcomes	accredited	333	34.97	5.25	1.74	263.40	.08
	non-accred	154	33.99	6.05			
Level of Satisfaction	accredited	340	24.70	4.67	.42	493	.68
	non-accred	155	24.51	4.60			

To further analyze these differences, independent-sample *t* tests were conducted for both of these variables' items. The results for the items measuring the variable curriculum are given in Table 6.

Table 6. *Independent Samples t test Comparing How Students' Perceptions of Curriculum Differ Based on the Accreditation Status of Their Program (N_a=344, N_n=157)*

	accreditation status	N	M	SD	*t*	df	*p*
q2	accredited	335	3.70	0.91	1.95	274.03	.05
	non-accred	155	3.51	1.01			
q11	accredited	343	4.10	0.77	3.06	262.16	.00
	non-accred	157	3.85	0.91			
q14	accredited	344	4.50	0.71	3.21	242.19	.00
	non-accred	157	4.24	0.93			
q25	accredited	343	3.99	0.89	1.75	273.64	.08
	non-accred	156	3.83	0.98			
q32	accredited	334	4.26	0.75	2.54	487	.01
	non-accred	155	4.07	0.80			
q38	accredited	344	3.87	0.97	-.28	499	.78
	non-accred	157	3.90	0.93			
q45r	accredited	341	3.85	1.01	2.97	274.72	.00
	non-accred	155	3.54	1.11			

r denotes item reversal

As depicted in Table 6, all of the items measuring quality of curriculum had higher mean scores in accredited programs with the exception of q38 “There is a good variety of courses outside my major available to me each term”, which reported a higher mean score by students in non-accredited programs, although the difference was not significant. Curricula criteria in particular, are often cited by programs as being too difficult to meet and is often given as the reason for not seeking specialized accreditation (Prather, 2007). The finding from this study suggests that accreditation criteria leads to higher quality curricula and should therefore be considered by all faculty and program administrators when developing and revising curricula, whether or not AABI accreditation is being sought. An analysis of the items used to measure facilities and equipment is given in Table 7.

With the exception of q50 “Aircraft are available to meet students’ needs”, all of the items measure facilities and equipment reported higher means scores by students in accredited programs. Items q10 “Library resources and services are adequate;” q18 “The campus facilities and grounds are well maintained;” and q49 “Aircraft are well maintained,” all reported significantly higher means for the accredited programs. The majority of the items used to measure facilities and equipment were not aviation specific, but rather a measure of the overall physical condition and aesthetics of the campus and included such things as laboratory facilities, library resources, classroom space, etc., and are often a key component in student recruitment. Facilities and equipment measures did include aircraft availability and maintenance for students in programs involving flight training. How well aircraft were maintained (q49) was reported significantly higher by students in accredited programs. No difference was found on students’ perception of aircraft availability (q50), which received the lowest mean score in both groups. This finding suggests that program administrators should take the necessary steps to ensure aircraft are available to meet students’ flight hour requirements. Preliminary follow up on this issue indicated that collegiate aviation programs limit enrollment based on the available fleet size and that students perceived the lack of available aircraft merely because aircraft were not available for their first choice of flight times.

Table 7. *Independent Samples t test Comparing How Students’ Perceptions of Facilities & Equipment Differ Based on the Accreditation Status of Their Program (N_a=344, N_n=157)*

	accreditation status	N	M	SD	*t*	df	*p*
q5	accredited	328	3.75	0.93	1.65	480	.10
	non.accred	154	3.60	0.98			
q10	accredited	343	4.09	0.88	2.42	269.42	.02
	non.accred	157	3.87	1.00			
q12	accredited	338	4.10	0.84	.29	493	.77
	non.accred	157	4.08	0.93			
q18	accredited	343	4.26	0.82	2.99	498	.00
	non.accred	157	4.01	1.00			
q31	accredited	343	4.22	0.81	.26	498	.79
	non.accred	157	4.20	0.84			
q49	accredited	295	4.42	0.91	4.44	419	.00
	non.accred	126	3.98	0.95			
q50	accredited	294	3.72	1.32	-.39	280.40	.70
	non.accred	126	3.77	1.10			

The results of the *t* tests for the variables student outcomes and faculty were approaching significance as depicted in Table 5. An item analysis of these variables was conducted to see if any significant differences existed between accredited and non-accredited programs. The analysis for the items measuring student outcomes is given in Table 8.

Students in accredited programs reported higher mean scores for nine out of the ten items measuring outcomes. Item q17 "This degree is preparing me well for my intended career," was significantly higher for students in accredited programs. Nearly 87 percent of students in accredited programs agreed or strongly agreed that their program was preparing them well for their intended career, compared with 76 percent of students in non-accredited programs. Program quality can be measured by how well the end product, i.e. outcomes, has met the intended purpose of the users (Harvey and Green, 1993). This particular finding suggests that accredited programs are of higher quality when this functional definition of quality is used. The analysis of items measuring faculty is given in Table 9.

Table 8. *Independent Samples t test Comparing How Students' Perceptions of Outcomes Differ Based on the Accreditation Status of Their Program (N_a=344, N_n=157)*

	accreditation status	N	M	SD	*t*	df	*p*
q4	accredited	344	4.19	0.79	1.42	498	.16
	non.accred	156	4.08	0.86			
q9	accredited	340	3.89	0.86	1.53	251.34	.13
	non.accred	157	3.74	1.08			
q17	accredited	343	4.32	0.81	2.36	498	.02
	non.accred	157	4.13	0.94			
q23r	accredited	342	3.78	1.03	1.41	495	.16
	non.accred	155	3.64	1.06			
q28	accredited	343	3.57	1.06	1.80	497	.07
	non.accred	156	3.39	1.06			
q30	accredited	343	4.04	0.86	1.14	497	.25
	non.accred	156	3.95	0.86			
q36	accredited	342	3.67	0.93	.05	497	.96
	non.accred	157	3.66	1.00			
q41	accredited	341	3.68	0.96	-.08	496	.94
	non.accred	157	3.69	0.99			
q47	accredited	341	3.78	0.92	.71	496	.48
	non.accred	157	3.72	0.94			

r denotes item reversal

Although the overall mean score for the variable faculty was not significantly higher in accredited programs (p = .11), it is interesting to note that *every* item reported a higher mean score by students in accredited programs and that several significant differences in the quality of faculty were found between the groups. Students in accredited programs perceived their aviation faculty members to be more scholarly and professionally competent (q6); as coming to class better prepared (q13); to be more enthusiastic about what they are teaching (q19); and to be more aware of new developments in the field (q44), compared with faculty in non-accredited programs. Students in accredited programs reported instruction in their major field as excellent (q42) significantly more than students in non-accredited programs. Faculty was listed among the top quality characteristics of collegiate aviation in Hankins (2007) research. Additionally, programs often cite benefits in faculty recruitment as one of their reasons for seeking specialized accreditation (Prather, 2007). This analysis of items measuring the quality of faculty supports this reasoning.

Table 9. *Independent Samples t test Comparing How Students' Perceptions of Faculty Differ Based on the Accreditation Status of Their Program (N_a=344, N_n=157)*

	accreditation status	N	M	SD	*t*	df	*p*
q6	accredited	343	4.39	0.84	2.30	254.38	.02
	non.accred	157	4.18	1.03			
q13	accredited	344	4.36	0.74	2.27	499	.02
	non.accred	157	4.19	0.89			
q15	accredited	343	4.38	0.74	.57	497	.57
	non.accred	156	4.33	0.84			
q19	accredited	344	4.39	0.72	2.28	499	.02
	non.accred	157	4.22	0.80			
q22	accredited	329	3.84	0.81	.37	256.10	.71
	non.accred	152	3.81	0.95			
q26	accredited	344	3.97	0.79	.58	266.65	.56
	non.accred	155	3.92	0.90			
q34r	accredited	343	3.71	1.05	.95	498	.34
	non.accred	157	3.61	1.09			
q40r	accredited	340	3.64	1.00	.32	493	.75
	non.accred	155	3.61	1.07			
q42	accredited	344	4.24	0.82	2.00	498	.05
	non.accred	156	4.07	0.93			
q44	accredited	343	4.32	0.79	2.16	496	.03
	non.accred	155	4.15	0.77			

r denotes item reversal

IMPLICATIONS OF THE STUDY

It is important for administrators and directors of collegiate aviation programs to sustain a satisfied student body to ensure their program's viability. This study set out to ascertain if there was a difference between students' perceptions of quality in accredited and non-accredited programs. The population sampled consisted of students aged 18 – 64 years currently enrolled in a non-engineering four year aviation degree program in the United States. Quality was defined by the dimensions of curriculum, faculty, environment, facilities and equipment, student outcomes and overall satisfaction.

The findings indicate that while students in both groups perceived the quality of their programs to be high, several significant differences were found between the two groups. Student perception of their curriculum was significantly higher for the accredited programs, suggesting that the accrediting criteria and standards may lead to higher caliber curricula. Facilities and equipment was also perceived significantly higher by students in accredited programs. Many of the items used to measure this dimension such as library resources, computer labs, campus buildings and grounds, etc. are a measure of the institution, rather than of the aviation program, and have little to do with an individual program's accreditation status. Caution should therefore be exercised before any cause (accreditation) and effect (higher quality) relationship is assumed for this particular quality dimension. However, the perception of how well aircraft were maintained was significantly higher for the accredited group and is worthy of note.

Significant differences were also found to exist for several of the items used to measure faculty, supporting the belief that attaining specialized accreditation attracts high caliber faculty. A significant difference in students' perception of outcomes between accredited and non-accredited programs was also noted. Students in accredited programs perceived their degree program to be preparing them well for their intended degree to a greater extent than students in non-accredited programs.

The following recommendations for improving the quality of collegiate aviation programs based on this study's findings include:

1. Non-accredited programs should consider seeking AABI accreditation. Several measures of quality were significantly higher for the accredited programs.
2. If unable to seek accreditation at the present time due to lack of resources, program faculty and administrators should at least consider developing and revising their curricula based on the AABI criteria.
3. Aircraft scheduling should be monitored to ensure that aircraft are available to meet student needs as both programs reported the lowest mean score for this item under the facilities and equipment variable.

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APPENDIX A

Survey
(student format)

Survey on students' perception of quality in their aviation program

Institution: __________________________ (please fill in the name of your school)

Major: _____________________________ (please fill in title of your degree program, such as professional pilot, aviation administration, air traffic control, etc)

1. Gender: male ___ female ___

2. Class level: freshman ___ sophomore ___ junior___ senior ___

3. What is your GPA? _______

_____ under 2.0

_____ 2.0 – 2.49

_____ 2.5 – 2.99

_____ 3.0 – 3.49

_____ over 3.5

Please answer the following questions on a sliding scale of 1 – 5 as follows:

Not important/ not satisfied	**Slightly important/ slightly satisfied**	**Moderately imp/ moderately satisfied**	**Important/ satisfied**	**Very important/ very satisfied**
1	**2**	**3**	**4**	**5**

4. How important was the school's location in your decision to enroll? 1 2 3 4 5

5. How important was the program's cost in your decision to enroll? 1 2 3 4 5

6. How important was the program's reputation in your decision to enroll? 1 2 3 4 5

7. How important are internship opportunities to you? 1 2 3 4 5

8. How satisfied are you with internship opportunities offered at your institution? 1 2 3 4 5

9. How important is the opportunity to participate in extracurricular activities such as flying teams, student chapters of national organizations (AAAE, Woman in Aviation, alpha eta rho, etc) to you? 1 2 3 4 5

10. How satisfied are you with the opportunity to participate in extracurricular activities at your institution? 1 2 3 4 5

Part II

Using the scales below, please indicate your level of agreement with each of the following statements:

Strongly Disagree	Somewhat Disagree	Agree	Somewhat Agree	Strongly Agree
1	2	3	4	5

1. Acceptance of transfer credits from another institution is reasonable. 1 2 3 4 5
2. Advanced course offerings include internships or senior projects. 1 2 3 4 5
3. Billing policies are reasonable. 1 2 3 4 5
4. I have learned to adapt to change. 1 2 3 4 5
5. Science laboratories are well equipped. 1 2 3 4 5
6. Faculty members are scholarly and professionally competent in my major. 1 2 3 4 5
7. Class change (drop, add, withdraw) policies are reasonable. 1 2 3 4 5
8. If I could start over, I would enroll in this program again. 1 2 3 4 5
9. My interpersonal skills have improved as a result of this program. 1 2 3 4 5
10. Library resources and services are adequate. 1 2 3 4 5
11. Coursework is academically challenging. 1 2 3 4 5
12. Computer labs are adequate and accessible. 1 2 3 4 5
13. Faculty members come to class well prepared. 1 2 3 4 5
14. Content of course material in my major is relevant to the career I am pursuing. 1 2 3 4 5

Strongly Disagree	Somewhat Disagree	Agree	Somewhat Agree	Strongly Agree
1	2	3	4	5

15. Faculty members are accessible to me outside of class (office hours, email or phone). 1 2 3 4 5

16. Tuition paid is a worthwhile investment. 1 2 3 4 5

17. This degree is preparing me well for my intended career. 1 2 3 4 5

18. The campus facilities and grounds are well maintained. 1 2 3 4 5

19. Faculty members are enthusiastic about what they are teaching. 1 2 3 4 5

20. Many required courses are only offered sporadically. 1 2 3 4 5

21. I often get the "run-around" when seeking information on campus 1 2 3 4 5

22. Faculty members are willing to work collaboratively with students on research efforts 1 2 3 4 5

23. This program has done little in developing my critical thinking skills. 1 2 3 4 5

24. I would recommend this program to a friend. 1 2 3 4 5

25. There are sufficient courses within my major available to me each term. 1 2 3 4 5

26. Faculty members provide timely feedback on my academic progress. 1 2 3 4 5

27. Office staff (registrar, bursar, financial aid office, department secretary) are caring and helpful. 1 2 3 4 5

28. This program developed my understanding of people from different backgrounds. 1 2 3 4 5

29. It is enjoyable being a student in this program. 1 2 3 4 5

30. This program has developed my ability to learn independently. 1 2 3 4 5

31. Classroom space is adequate. 1 2 3 4 5

32. Upper level courses build on knowledge obtained in earlier courses. 1 2 3 4 5

33. I am satisfied with my experiences here. 1 2 3 4 5

34. Faculty expectations are not made clear to me. 1 2 3 4 5

Strongly Disagree	Somewhat Disagree	Agree	Somewhat Agree	Strongly Agree
1	2	3	4	5

35. There is a strong sense of community within the department. 1 2 3 4 5

36. The program has improved my oral and written communication skills. 1 2 3 4 5

37. Enrollment in many of my classes was too high. 1 2 3 4 5

38. There is a good variety of courses outside my major available to me each term. 1 2 3 4 5

39. I have the opportunity to interact with students from different economic, social and ethnic backgrounds. 1 2 3 4 5

40. Faculty fail to take into account student differences when teaching a course. 1 2 3 4 5

41. My use of technology has improved over the course of this program. 1 2 3 4 5

42. Instruction in my major field is excellent 1 2 3 4 5

43. Registering for courses is done efficiently. 1 2 3 4 5

44. Faculty members are aware of new developments in the field. 1 2 3 4 5

45. Many required textbooks are not up to date. 1 2 3 4 5

46. Students mutually support each other. 1 2 3 4 5

47. This program developed my ability to function as a member of a group. 1 2 3 4 5

48. I intend to complete the program I am currently enrolled in at this institution. 1 2 3 4 5

If you have completed any flight training at your institution, please answer the following:

49. Aircraft are well maintained. 1 2 3 4 5

50. Aircraft are available to meet students' needs 1 2 3 4 5

Appendix B
Survey items grouped by variable

<u>Curriculum</u>

q2: Advanced course offerings include internships or senior projects.
q11: Coursework is academically challenging
q14: Content of course material in my major is relevant to the career I am pursuing.
q25: There are sufficient courses within my major available to me each term.
q32: Upper level courses build on knowledge obtained in earlier courses
q38: There is a good variety of courses outside my major available to me each term
q45: Many required textbooks are not up to date.

<u>Faculty</u>

q6: Faculty members are scholarly and professionally competent in my major
q13: Faculty members come to class well prepared
q15: Faculty members are accessible to me outside of class (office hours, email or phone)
q19: Faculty members are enthusiastic about what they are teaching
q22: Faculty members are willing to work collaboratively with students on research efforts
q26: Faculty members provide timely feedback on my academic progress
q34: (r) Faculty expectations are not made clear to me
q40: (r) Faculty fail to take into account student differences when teaching a course
q42: Instruction in my major field is excellent
q44: Faculty members are aware of new developments in field

<u>Environment</u>

q1: Acceptance of transfer credits from another institution is reasonable
q3: Billing policies are reasonable
q7: Class change policies (drop, add, withdraw) are reasonable
q21: (r) I often get the "run-around" when seeking information on campus
q27: Office staff (registrar, bursar, financial aid office, department secretary) are caring and helpful
q35: There is a strong sense of community within the department
q37: (r) Enrollment in many of my classes was too high
q39: I have the opportunity to interact with students from different economic, social and ethnic backgrounds.
q43: Registering for courses is done efficiently
q46: Students mutually support each other

<u>Facilities and equipment</u>

q5: Science laboratories are well equipped
q10: Library resources and services are adequate
q12: Computer labs are adequate and accessible
q18: The campus facilities and grounds are well maintained
q31: Classroom space is adequate
q49: Aircraft are well maintained
q50: Aircraft are available to meet students' needs

Student outcomes

q4: I have learned to adapt to change
q9: My interpersonal skills have improved as a result of this program
q17: This program is preparing me well for my intended career
q23: (r) This program has done little in developing my critical thinking skills
q28: This program developed my understanding of people from different backgrounds
q30: This program has developed my ability to learn independently
q36: The program has improved my oral and written communication skills
q41: My use of technology has improved over the course of this program
q47: This program developed my ability to function as a member of a group

Overall satisfaction

q8: If I could start over, I would enroll in this program again
q16: Tuition paid is a worthwhile investment
q24: I would recommend this program to a friend
q29: It is enjoyable being a student in this program
q33: I am satisfied with my experiences here.
q48: I intend to complete the program I am currently enrolled in at this institution.

Process Oriented Guided Inquiry Learning (POGIL), A Teaching Method From Physical Sciences, Promotes Deep Student Learning In Aviation

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ABSTRACT

Aviation educators can increase the depth of student learning in their classes by implementing Process Oriented Guided Inquiry Learning (POGIL). The goal of this study was to determine whether POGIL, a uniquely effective teaching strategy used primarily in chemistry or biology, stimulates deeper student learning outside the flight lab. Results from measured test scores on identical assessment instruments between the control and experimental groups indicate the use of POGIL can significantly increase the depth of student learning in collegiate aviation classes with or without a flight lab.

INTRODUCTION

Aviation education takes place both in the classroom and in the aircraft. The aircraft is a highly motivating three-dimensional laboratory setting where students can test and apply knowledge and receive instantaneous and intense feedback. "Flight lab" learning is gestalt, stimulating multiple senses and engaging several domains of learning, and gestalt experiences generally result in deeper learning (Ratey, 2002). The author's observations of typical aviation classroom learning and conversations with students indicate that much learning is not gestalt but rather focuses mostly on rote learning, resulting in less student engagement and shallow learning. Students frequently describe typical lecture-based aviation classes as "boring" in course evaluations. That is particularly concerning to teachers of the millennial generation of students who are used to a more stimulating environment (Niemczyk & Ulrich, 2009). The goal of this study is to determine whether Process Oriented Guided Inquiry Learning (POGIL), a uniquely effective teaching strategy used primarily in chemistry or biology, stimulates deeper student learning outside the flight lab in collegiate aviation education. POGIL was chosen because of the strong similarities between flight lab learning and the POGIL model. Aviation educators have been teaching effectively in the aircraft all along, but many have not made an explicit transfer of the same principles to the classroom.

What is Process Oriented Guided Inquiry Learning (POGIL)?

POGIL is a pedagogical technique that synthesizes teaching both content and process skills together. Such goals as student collaboration and teamwork and analytical thinking are part of POGIL activities. (What is Process Oriented Guided Inquiry Learning, 2010). "POGIL is based on research indicating that a) *teaching by telling* does not work for most students, b) students who are part of an interactive community are more likely to be successful, and c) knowledge is personal; students enjoy themselves more and develop greater ownership over the material when they are given an opportunity to construct their own understanding." (What is POGIL, 2010). POGIL also promotes peer learning, which has been shown to significantly increase the depth of student understanding, especially on the part of the peers acting as teacher (Hockings et al, 2008). Essentially, POGIL is more specific, structured, and focused than "regular" group work, and promotes even deeper student learning.

While POGIL has traditionally been used in large, science education classes such as general chemistry, organic chemistry, or biology (Effectiveness of POGIL, 2010), it is adaptable to other disciplines. A classroom using POGIL consists of small groups of students working on specifically designed problems and materials (Hanson, 2006). The materials give students a limited amount of information followed by questions designed to guide them to formulate their own conclusions using the scientific method. The teacher serves as a guide and discussion facilitator, observing the small group dynamics and answering individual and group-generated questions. (What is POGIL, 2010). While the purpose of this article is not to provide a guide to using POGIL, a sample POGIL activity follows in Appendix A for illustration. More information about POGIL theory and techniques is available at www.pogil.org. In studies of teaching and learning, POGIL has demonstrably increased the depth of student learning in the physical sciences (Hanson, D.M., 2006; Farrell, J.J. et. al., 1999, Heller, P., et al., 1992). Although a common concern about using POGIL is that less class time is available to cover content, POGIL explicitly and effectively rewards student preparation for content acquisition, (Straumanis A., and Simons E. (2006) and the combination of content acquisition with process skills ensures required content will be covered.

Deep Learning Occurs in Multiple Cognitive Domains

This author has observed that much traditional classroom instruction in collegiate aviation focuses on lecture and memorization. While that is efficient in terms of basic content acquisition, deep learning involves more than that. Teachers encourage deep student learning by engaging students in multiple domains. One of the effects of using POGIL in the classroom is that student learning is facilitated in a variety of domains, not just the cognitive domain. It is well accepted that students learn in multiple domains (Ratey, 2002) and separation of emotion, cognition, and the physical body is no longer pedagogically acceptable as it once was. Students learn most deeply in gestalt experiences, and POGIL provides a pedagogical tool to facilitate that. In aviation, teachers and instructor pilots use similar methodology to POGIL when teaching “flying” courses--those courses that involve a laboratory component where the student learns specific aviation skills and applies them in flight. In fact, flight instructor trainees are explicitly taught fundamentals of instruction for aviation which are strikingly similar to a well-designed POGIL lesson (Aviation Instructor’s Handbook, 2008).

Authentic Assessment is Necessary for Deep Learning

Authentic assessment is assessment that aims for realism, where the evaluated task reproduces how a student’s knowledge and abilities are tested in real life situations. It requires students to use judgment, innovation, and their toolbox of learned knowledge and skills to perform a complex task or solve a complex problem. Students must integrate multiple skills. Finally, authentic assessment is formative rather than summative--students have opportunities to practice their skills and get feedback on their performance without fear of evaluation pressure. (Wiggins, 1998). While this kind of assessment occurs routinely in the aircraft when practicing maneuvers with instructor pilots, it is less common in an ordinary classroom.

In aviation, an illustrative example of authentic assessment is the first solo flight. Rather than testing whether a student can remember aircraft speeds and limitations and air traffic control procedures via written quiz, the student performs a solo flight and concretely demonstrates ability to do those things. Authentic assessment like that is real, and is also highly motivating in this author’s experience. The more relevant and realistic the assessment, the more likely students will be motivated to learn the underlying material deeply to perform well on assessment.

RESEARCH METHODOLOGY

POGIL was selected as the teaching method to be tested. It has been shown to be successful in promoting deep learning in chemistry and biology, so the author wondered whether it would have a significant effect in collegiate aviation education. The following hypothesis was established for the purpose of this study:

H0: POGIL has no significant effect on the depth of collegiate aviation students' learning.
H1: POGIL has a significant effect on the depth of collegiate aviation students' learning.

Because of the complex variables affecting student learning, no one single inquiry into the effect of a particular method on the depth of student learning can be conclusive (Entwistle, 2009 at 5). But an accepted measurement of depth of learning begins with an analysis of whether basic content knowledge is merely surface, or rote, learning (Tagg, 2003; Aviation Instructor's Handbook, 2008) or whether it encourages students to explore underlying meanings and apply their knowledge in real-world situations (Tagg, 2003; Biggs,1989; Aviation Instructor's Handbook, 2008). "Deep learning is learning that takes root in our apparatus of understanding." (Tagg, 2003 p. 70). Simply put, if aviation students can apply their knowledge of facts, regulations, or aircraft limitations in a task that simulates a complex in-flight situation, they have demonstrated deeper learning--an apparatus of understanding--that can be measured.

Study Design

The study was conducted over two consecutive semesters after the author participated in a POGIL training workshop. The first semester (the control group) was conducted the same way as the author had always taught the courses – lecture-based and content-focused. During that semester the POGIL activities were created for use the next semester (the experimental group). The same two classes, IFR Regulations and Procedures and Aviation Law, were taught in the control semester and experimental semester. Both the control group and the experimental group were notified that their class was the subject of a research study and had the option to switch to another section taught by a different professor. The study timeline follows in tabular form:

Table 1. *Timeline of Study Design*

Semester	Activity	Assessment
Summer	POGIL training workshop	
Fall (control)	Traditional lecture & Creation of POGIL lessons	Pre & Post tests
Spring (experimental)	POGIL lessons	Pre & Post tests

While the classes are different and IFR Regulations and Procedures has a flight lab associated with it, the study does not attempt to measure any effect POGIL has between classes within the experimental group, or whether it is more effective in certain classes than others. The study is designed to measure solely whether POGIL has an effect on overall learning within collegiate aviation.

Identical syllabi, course content, classroom materials, management software (class website), and assessment tools were used for both control and experimental groups. The same professor taught both groups. The POGIL activities were developed in accordance with POGIL guidance for each class in the experimental semester and used in substitution of traditional class lectures throughout the experiment semester. Initial knowledge assessments and final examinations were compared using an independent samples *t*-test, and inter-class block exams and other assessments were compared using Analysis of Variance (ANOVA). A *t*-test assesses whether the means of two groups are statistically different from each other. This analysis is appropriate in comparing the means of only two groups, where the ANOVA generalizes a *t*-test to more than two groups. (Trochim & Donnelly, 2006). For significance, the critical p value was $p < .05$.

Sample Selection

The participating collegiate aviation students were regularly enrolled undergraduate students within several majors in the department of Aviation at the University of North Dakota. Institutional Review Board (IRB) approval was granted to compare the students' assessment scores after de-identification of the assessment tool. All subjects were given the option of opting out of participation by placing a discreet symbol on their assessment and again once the assessments had been graded. No subjects opted out.

Four total classes of two different academic subjects were used as samples. The classes were IFR Regulations and Procedures and Aviation Law. The control groups (one IFR class and one law class) were taught in Fall and the experimental groups (one of each) were taught in Spring. The mean and median sample sizes were 22 students. Demographically, females were underrepresented (no female subjects in either IFR classes) and 2 and 3 females in the Law control and experimental classes, respectively. Ages were typical of university sophomores (IFR) and senior (Law) classes. Between groups, therefore, the control and experimental samples were demographically similar.

POGIL activities

Learning groups or teams are an integral part of POGIL, and students spend much of class time working in small learning teams, different from traditional lecture-based classes of between 15-30 students. In a small team setting, it is important to structure the team by assigning different roles to students to ensure consistency of process. While the team's membership may be flexible to accommodate changes throughout the semester and the students may play different roles, the roles themselves should remain constant to facilitate the process. The teams used in the experimental groups were as follows:

- <u>Manager</u> Manages the group. Ensures that members are fulfilling their roles, that the tasks are being accomplished on time, and that all group members participate. The instructor responds to questions from the manager only, who must raise his or her hand to be recognized.
- <u>Presenter</u> Presents oral reports to the class using recorder's notes. The reports should be short and concise.
- <u>Recorder</u> Records the group's consensus answers, notes any dissent, discussions, observations, etc., to be reported to the class. It may also include a log of the concepts the group has learned.
- <u>Researcher</u> Performs all the technical operations, searches, or other data operations for the group. Only the researcher in each group may use a computer, phone, or other technical equipment in solving the problem.
- <u>Processor</u> Acknowledges the good ideas and insights of group members or the group as a whole at appropriate times in writing. Also observes and comments on group dynamics. These acknowledgements and observations must be attached to the recorder's notes at the conclusion of the exercise, but need not be reported orally by the reporter.

While other team roles may be used (e.g. an encourager or a significant figure checker), these four categories worked in the experimental groups. The team manager was free to assign additional or multiple roles as he or she saw fit.

The teams were given explicit activities designed specifically for the learning objective at hand, which varied by lesson. For illustration, one example POGIL activity the author designed follows in Appendix A and a guide for determining the extent to which an instructional activity supports POGIL follows in Appendix B. These examples are only to show the structure of a potential POGIL activity. More information about the POGIL model can be found at www.pogil.org.

RESULTS

In the following tables, PreTest/Pre stands for an initial assessment given on the first day of class which measured student familiarity with the course subjects. Blocks 6, 7, and 8 refer to each assessment (exam) given at the conclusion of the specified learning block. Final stands for the final exam for the course, which was cumulative. Initial knowledge assessments and final examinations were compared using a *t*-test (assesses only whether the means of two groups are statistically different), and block exams 6, 7, and 8 and final assessments were compared using an ANOVA (compares the means of multiple groups). For significance, the critical *p* value was $p < .05$.

Table 2 shows the descriptive statistics for IFR Regulations and Procedures for the control group (11 students) and the experimental POGIL group (19) students). The samples' N values remain constant throughout the experiment. The mean test scores for each group are shown, with the standard deviation and other descriptive statistics for the groups' exam scores. These descriptive statistics were used for further testing in an Analysis of Variance (ANOVA) below.

Table 2. *IFR Regulations and Procedures Class –Descriptive Statistics*

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PreTest	Control	11	62.7273	10.46987	3.15678	55.6935	69.7610	41.00	78.00
	POGIL	19	61.8947	10.99947	2.52345	56.5932	67.1963	44.00	81.00
	Total	30	62.2000	10.63306	1.94132	58.2295	66.1705	41.00	81.00
Block 6	Control	11	88.0909	5.61168	1.69198	84.3209	91.8609	81.00	97.00
	POGIL	19	88.1579	5.18827	1.19027	85.6572	90.6586	76.00	97.00
	Total	30	88.1333	5.25051	.95861	86.1728	90.0939	76.00	97.00
Block 7	Control	11	93.2727	2.37027	.71466	91.6804	94.8651	89.00	97.00
	POGIL	19	86.1579	9.18491	2.10716	81.7309	90.5849	68.00	100.00
	Total	30	88.7667	8.15236	1.48841	85.7225	91.8108	68.00	100.00
Block 8	Control	11	94.9091	4.18221	1.26098	92.0994	97.7187	86.00	100.00
	POGIL	19	88.9474	6.32871	1.45191	85.8970	91.9977	76.00	100.00
	Total	30	91.1333	6.27932	1.14644	88.7886	93.4781	76.00	100.00
FINAL	Control	11	89.4545	3.58786	1.08178	87.0442	91.8649	84.00	93.00
	POGIL	19	94.2632	4.56852	1.04809	92.0612	96.4651	81.00	99.00
	Total	30	92.5000	4.79044	.87461	90.7112	94.2888	81.00	99.00

Table 3 shows there was no significant difference between the pretests (p = .840) or the block 6 exam (p = .974) between groups. There was a significant difference between the block 7 (p =. 018), block 8 (p = .010) and final exams (p= .006) between groups.

Table 3. *IFR Regulations and Procedures Class – ANOVA*

		Sum of Squares	df	Mean Square	F	Sig.
PreTest	Between Groups	4.829	1	4.829	.041	.840
	Within Groups	3273.971	28	116.928		
	Total	3278.800	29			
Block 6	Between Groups	.031	1	.031	.001	.974
	Within Groups	799.435	28	28.551		
	Total	799.467	29			
Block 7	Between Groups	352.659	1	352.659	6.271	.018
	Within Groups	1574.708	28	56.240		
	Total	1927.367	29			
Block 8	Between Groups	247.610	1	247.610	7.739	.010
	Within Groups	895.856	28	31.995		
	Total	1143.467	29			
FINAL	Between Groups	161.089	1	161.089	8.942	.006
	Within Groups	504.411	28	18.015		
	Total	665.500	29			

Table 4 shows the group statistics for the Aviation Law samples for both control (N=30) and experimental POGIL group (N = 25). One subject from the POGIL group failed to take the final exam which was treated as missing data in the analysis.

Table 4. *Aviation Law Class –Group Statistics*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Control	30	60.5000	14.64464	2.67373
	POGIL	25	55.9200	10.90841	2.18168
Final	Control	30	88.6000	5.86398	1.07061
	POGIL	24	91.9583	5.52842	1.12848

Table 5 shows an independent samples test for the Aviation Law class. A *t*-test was used for Aviation Law because the individual assessment data for in-class assignments, quizzes, and tests was aggregated into frequency-only data and the original data was lost. Since standard deviation could not be calculated from frequency data alone, an ANOVA could not be performed to assess whether there was an effect within the class assessments. The results table from the *t*-test shows that there was no significant difference between pretests (p = .202 or .190) but there was a significant difference between the final exams (p = .037 or .036).

Table 5. *Aviation Law Class – Independent Samples T-Test*

		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tail)	Mean Diff.	Std. Error Diff.	Lower	Upper
Pre	Equal variances assumed	3.77	.057	1.292	53	.202	4.58000	3.54360	-2.5275	11.68755
	Equal variances not assumed			1.327	52.403	.190	4.58000	3.45088	-2.3434	11.50343
Final	Equal variances assumed	.199	.657	-2.14	52	.037	-3.35833	1.56593	-6.5006	-.21606
	Equal variances not assumed			-2.15	50.554	.036	-3.35833	1.55553	-6.4818	-.23480

DISCUSSION

Limitations

The small sample sizes, lack of longitudinal assessment and consequent absence of *post-hoc* tests limit the conclusions that can be drawn from this study. Demographical limits in the samples may limit the applicability of the conclusions. Missing data from the Aviation Law in-class assessments (which would otherwise mirror the block 6, 7, & 8 tests from IFR Regulations and Procedures) limit the findings from the Aviation Law class. Finally, the two classes measured are inherently different and no conclusions can be drawn from their comparison.

Differences

Overall, the data support rejecting the null hypothesis and supports H1, that POGIL made a significant difference ($p < .05$) on collegiate aviation students' learning. This difference was significant in both IFR Regulations and Procedures and Aviation Law (courses with a flight lab component and without a flight lab), namely that the differences between the initial knowledge assessments of both groups compared with the final exam scores was significant.

While the two classes in the experimental group are qualitatively different and no conclusions can be drawn from their comparison, the author found it interesting that the effect of POGIL on the flight lab class appeared to be stronger than for the non-flight lab class. This was contrary to what the author expected to see as a general matter, since flight lab courses are similar to POGIL on their own. More research needs to be done to determine the extent of this effect. Additionally, the effect of POGIL on the depth of learning appeared to increase throughout the semester. The *p* values continued to move linearly towards stronger significance ($p < .01$) throughout the semester for IFR Regulations and Procedures. More research needs to be done to explore these effects as well.

CONCLUSIONS

Aviation educators can increase the depth of student learning in their classes by implementing POGIL. While a drawback to adopting POGIL is the initial amount of preparation in terms of learning the POGIL method as a teacher, student learning in both flight lab courses and non flight lab courses can be significantly improved by implementing POGIL. From the results of this study, it appears that the POGIL model itself is adaptable to the aviation discipline. While further research is necessary to determine the magnitude of POGIL's effect within different kinds of aviation classes, this study supports the existing body of research that indicates POGIL can increase the depth of student learning in the sciences and extends the principles of POGIL specifically to aviation education.

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APPENDIX A

Sample POGIL Activity

Go time!

It's go time! You have an emergency airlift to do today. Your mission is to transport a critical care patient from Baudette, MN to Duluth, MN, and pick up a package of live human tissue at Duluth and get it to Anoka, MN (near Minneapolis).

PREREQUISITES
IFR Enroute chart legend
AIM 5-3-1 to 5-3-7

LEARNING OBJECTIVES
Identify elements of IFR low altitude charts
Plan an efficient route of flight using low altitude charts

EXPLORATION
In your groups, identify the fastest way using both Victor airways and direct routing from BDE to DLH and from DLH to ANE. Write down your proposed route of flight. Your group manager should be prepared to explain why you chose the route you did.

KEY QUESTIONS
1. What is the MEA to HIB?
2. What is the MOCA to HIB?
3. What is the distance from BDE – SQEAK?
4. What is the distance from HIB – DLH?
5. Near SQEAK there is an 88 in a box, what does this mean?
6. What airspace are you flying through on your way to HIB?
    a. Is this airspace active?
    b. Are there any problems with you flying through it if it is active?
    c. What do the Green (Jepp) or Brown (NOS) circles mean within this airspace?
7. What does the X (AYIHE) between HIB –DLH indicate?
8. What class airspace is KDLH?
9. Does DLH have HIWAS?

SKILL EXERCISES
1. What altitude would you file for the route section DLH – ANE? Why?
2. What is the brown line you cross?
3. Rush City has a holding pattern depicted. Why?
4. What do the grey dashed lines around MSP mean?
5. What frequency would you use to contact FSS in DLH?
6. How can you tell if there is DME at DLH?

PROBLEMS
1. Assume you're in BDE right now and ready to take off in 15 minutes. You choose to fly direct. Use the current weather and winds aloft. What altitude of flight would you choose and file?
2. You've made it to DLH and are ready to depart to ANE. In you updated briefing, you hear that flow control is in effect for MSP and to expect preferred IFR routes. Where do you find those, and would that affect your flight?

APPENDIX B

POGIL Screening Rubric

Chris Bauer, Renee Cole, & Karen Anderson, 2007

This rubric guides initial review of an instructional activity to determine how well the activity supports process-oriented and guided-inquiry learning. The review pertains only to the written description of the activity and not to how an instructor might facilitate its use. A "yes" response should indicate that evidence for that characteristic can be found in the instructional activity itself. The evidence must be explicit, i.e. reviewers should not assume that an instructor using the activity will provide anything that seems to be missing. If no explicit evidence can be found, then a "no" response is appropriate. If evidence is found, then a "yes" response is appropriate, irrespective of the perceived quality of that characteristic. The Initial Screening Rubric Guide elaborates on the meaning of each item.

ESSENTIAL CHARACTERISTICS	Yes	No	Comments
1 Independent of the instructor, students are expected to explore or study something – data, equations, diagrams, text, graphics, processes, methods, hands-on activities, etc. Some authors refer to this as "the model".			
2 This exploration is the first task in the activity regarding a new topic.			
3 Students are expected to articulate and record explanations			
4 The activity is structured to build towards a central idea.			
5 Students are expected to engage in practice or application of developing ideas.			
6 Students are expected to process information (describe, summarize, calculate, transform data to another representation).			
7 Students are expected to engage in problem solving or critical thinking tasks.			
8 In the body of the written materials, students are cued to share or interact with each other.			
9 Students are expected to assess what they have learned from the activity in terms of either process or content.			